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ABSTRACT

The Council on Library and Information Resources' (CLIR's) College Libraries Committee began its study of the innovative uses of technology on college campuses in the spring of 1998. A letter was sent to heads of libraries of colleges and mid-sized universities in the United States encouraging librarians who felt their institutions had used technology in a way that significantly enhanced teaching and learning and who were willing to host a study team for a site visit to apply to the project. Nine campuses were selected out of the 41 applicants and site visits were conducted between September 1998 and January 1999. A two-day conference in March 1999 focused on the environment that is most conducive to organizational change. Representatives from each of the nine case study sites were present to discuss which features of the programs they studied had been most successful. Sites included: (1) California Institute of Technology, Sherman Fairchild Library - A New High-Tech Library; (2) Carnegie Mellon University - A New Electronic Archives; (3) Indiana University/Purdue University at Indianapolis - Librarian-Scholar Collaboration in Learning Communities; (4) Lafayette College - An Interdisciplinary Team Approach; (5) Point Park College and the Carnegie Library of Pittsburgh, Library Center - A Public-Private Library Partnership; (6) Southern Utah University, Gerald R. Sherratt Library - One Librarian Introduces EAD (Encoded Archival Description) Finding Aids; (7) Stevens Institute of Technology - Electronic Access, Not Subscriptions; (8) Wellesley College, Margaret Clapp Library - A New High-Tech Center; and (9) West Virginia Wesleyan College - Laptops for Every Student. Four speakers provided additional perspective on the case studies. William Haden opened the conference by noting that with rapid developments in information technology, colleges today face new pressures to remain relevant, competitive, and effective. This was followed by two presentations, by Susan Jurow and Barbara Hill, on making change in higher education. Brian Hawkins then prepared participants with observations on the transformation of higher education. The presentations are provided in part 1 of this report, as are summaries of the ensuing discussion and

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recommendations for follow-up activities. Case studies appear in part 2 of the report. The CLIR Belmont conference participant list is appended. (AEF)

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Innovative Use of Information Technology by Colleges

August 1999

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COUNCIL ON LIBRARY AND INFORMATION RESOURCES

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Innovative Use of Information Technology by Colleges

August 1999

Council on Library and Information Resources
Washington, D.C.

Council on Library and Information Resources

The mission of the Council on Library and Information Resources (CLIR) is to identify the critical issues that affect the welfare and prospects of libraries and archives and the constituencies they serve, convene individuals and organizations in the best position to engage these issues and respond to them, and encourage institutions to work collaboratively to manage change. CLIR pursues its mission out of the conviction that information is a public good and of great social, intellectual, and cultural utility, and it is committed to building support for this operating premise.

CLIR's interests embrace the entire range of information resources and services, from traditional library and archival materials to emerging digital formats, and the entire network of organizations that gather, catalog, store, preserve, and distribute information and that help users gain access to it. CLIR's current interest in helping institutions cope with a transition to a digital environment reflects its enduring commitment to both the preservation of information resources over time and the provision of continued access to them.

The Council on Library and Information Resources works with many institutions, but it operates independently of any particular institutional or vested interests, and through the composition of its Board, seeks to bring a broadly representative perspective to its mission.

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Introduction

The Council on Library and Information Resources' (CLIR's) College Libraries Committee began its project of studying innovative uses of technology on college campuses in the spring of 1998. The president of CLIR and the chair of the College Libraries Committee wrote letters to heads of libraries of colleges and mid-sized universities in the United States to ask if they had used technology in a way that significantly enhanced teaching and learning on their campuses. The letter encouraged applications from librarians who were proud of their accomplishments and willing to host a study team for a site visit.

Forty-one libraries from all regions of the country applied. The College Libraries Committee and the CLIR staff selected nine campuses that offered an interesting view of how innovation could be applied. These institutions were not necessarily chosen for their state-of-the-art technology. Rather, they were chosen because their accomplishments would generate ideas that would stimulate and inspire other institutions to make changes on their campuses.

The site visits were conducted between September 1998 and January 1999. Draft versions of the case studies were completed in January. A two-day conference was planned for March at the Belmont Center in Maryland to discuss the environment that is most conducive to organizational change. The case studies, distributed to participants weeks before the conference, were to serve as a point of departure for a broader discussion of change that is transforming colleges and mid-sized universities.

CLIR invited 27 individuals to attend, including college presidents, library directors, faculty, professional association representatives, government employees, and technology experts. Representatives from each of the nine case study sites were present to discuss which features of the programs they studied had been most successful.

CLIR invited four speakers to provide additional perspective on the case studies and to generate discussion. William Haden, president of West Virginia Wesleyan College, opened the conference by noting that with rapid developments in information technology, colleges today face new pressures to remain relevant, competitive, and effective. These pressures will force colleges to change, and the library, in collaboration with faculty and information technology staff, will be at the heart of that change.

Haden's introduction was followed by two presentations on making change in higher education. Susan Jurow stressed the importance of understanding the process of change and what it takes for individuals to engage in projects to bring about change. Barbara Hill shared the strategies that were successful in a program, cosponsored by the American Council on Education and The W. K. Kellogg Foundation, to help colleges and universities succeed with comprehensive change.

Brian Hawkins prepared participants for the wide-ranging discussion with his observations on the transformation of higher education.

The presentations are provided in part one of this report, as are summaries of the ensuing discussion and recommendations for follow-up activities. The case studies appear in part two of this report.

— Deanna Marcum

Part I

Conference Presentations

Change: the Importance of the Process

Susan Jurow

In considering how academic libraries can be leaders in integrating information technology in teaching and learning, the subtext must be about change. Understanding how to effectively engage institutions and the people who work in them in productive change processes can help turn innovative ideas into reality.

The Importance of Process

How one undertakes a project, how one plans for it, and how the people affected are engaged by it are as important as the outcome. The process is critical to the long-term success of the project and the long-term health of the organization. Each project leaves an organizational legacy in its wake. Does it support and promote a healthy organizational culture and climate, or does it leave behind bruised feelings, mistrust, and animosity?

Usually, it takes the same amount of time to complete a project whether the human element is engaged or not. If the affected individuals are not engaged, the questions and concerns draw out the process well beyond the time frame envisioned by the planners. In the end, the organization is left with anger and mistrust that makes it equally, if not more, difficult to undertake the next major change.

A project that takes into account the human element by its very nature takes longer to complete. It anticipates the consensus building and learning that must take place for the process to succeed. It leaves in its wake individuals excited about the positive potential of change because they have experienced it firsthand. New process skills are developed that permit the next project to take place more swiftly and efficiently.

It is important to consider process in the overall management of an organization. Today's workplace requires individuals to have the emotional and intellectual capacity to be flexible enough for continuous change regardless of their job or position. They must have the skills to be successful within this context. For an organization to thrive, a bias toward innovation is required.

Susan Jurow is executive director of the College and University Personnel Association.

Preparing for Change

The assessment that leads to change is an important, but often overlooked, element in the success of a change process. In examining the potential for change, there are basically three possible assessments that can be made other than maintaining an acceptable status quo: that something needs to be improved; that something is broken, but can be fixed; or that something needs to be done differently. In any organization and for any given situation, the assessment is likely to vary among individuals, depending on the type and depth of their knowledge about the situation, and their position in the organization. Disagreement over approach or strategy is often rooted in disagreement over assessment.

Just as a medical prescription hinges on the diagnosis, the change process that is proposed will be driven by the assessment. Each change process has its own rhythms and requirements. Developmental change means doing something the same way, but better, using a technique such as process reengineering. Transitional change means finding a new way to do the same thing, such as automating a process. Transformational change means doing something different by creating new structures and new processes to fit new objectives.

Each organization has a unique history, culture, and staff. These variables should be assessed before a change process begins. The strategy for change must consider the organization's current capacity and capability for change.

An organization's history will include a range of experience with change initiatives that will inform attitudes toward the present one. Its culture will encourage or discourage innovation and risk-taking based on that history. Staff will have expectations, attitudes, and skills that help or hinder their ability to engage in a change initiative. Strategies for communication, participation, training, and the negotiation of roles and responsibilities must be tailored to the needs of the organization.

The change process should be allowed to take as long as necessary to complete. Change processes are usually driven, at least to some degree, by external realities. All too often, however, they are driven by someone's unrealistic view of how long a process *ought* to take. The time frame for a change initiative must allow for all the preparatory and ongoing maintenance activities that take place such as consensus building, communication, and training.

Elements of a Successful Change Process

There are three elements that must be considered in developing a successful change strategy: people, process, and structure. Thought should be given to both the skills and the attitude of the people involved. The process should take into account the stakeholders, time frame, context, and outcome. The formalized relationships and organizational imperatives through which work gets done—the structure—should be flexible enough to be reconfigured and reshaped as needed with changing circumstances.

Each new change initiative should be seen as an opportunity to increase individual and organizational capacity to engage in change.

There are examples in the case studies of how each of these elements can be addressed successfully. The commitment to organizational development skills training at Indiana University/Purdue University at Indianapolis (IUPUI) exemplifies the role of skills and structure in effective change processes. The training enables staff members to work together effectively in groups. The resulting collaborative team structure permits a level of individual and group flexibility that encourages and supports change initiatives.

Resistance to change can come not only from disagreement about the needs and the means, but also from the sense of "frustration and incompetence" like that described in the Wellesley case study. Some of these problems can be attributed to the need for skill development and some to a lack of shared vision. Some library staff members continue to resist change even though the academic libraries in which they work have changed considerably in the last 20 years. There needs to be a shared understanding that change is and will continue to be a normal part of organizational life.

In almost every case study, there is evidence of extensive consultation in project development and decision making. The key stakeholders—library and information technology staff, faculty, and students—are involved to ensure understanding of the goals and commitment to the outcomes. At CalTech, gaining the support of the faculty for consolidating library services required a compelling vision and clear communication not only of what would be new, but also of the quality of service that would be maintained.

Time and timing can be important to the success or failure of change processes. At Lafayette College, the initial project commitment was for one year. This gave the key players the time they needed to develop their skills and confidence before committing to a longer or ongoing process. In the public-private partnership in Pittsburgh, the planning phase for the change process took seven years, a daunting time frame in which to maintain momentum. And yet, this lengthy process gave planners the opportunity to incorporate emerging technologies into the project.

Articulating the objectives or expected outcomes helps stakeholders understand what a particular change process is designed to address. At Wellesley, the Knapp Center was established to support two college goals: to ensure each student a working knowledge of technology and to assist the faculty in incorporating information technology in their work. Setting expectations and establishing accountability help to ensure the credibility of change processes and set the stage for further ones.

The use of teams appears repeatedly in the case studies; at IUPUI, teams are found within a formal organizational structure. At Lafayette College, library and information technology staff cooperate in cross-functional teams. In either case, the teams encourage change efforts by bringing together the skills and perspectives needed to support the development and implementation of new programs.

The Challenge of Transformational Change

The projects described within the case studies run the gamut from developmental to transformational. The shift to electronic access at Stevens Institute of Technology is a clear example of a transformational change. Ready, immediate, in-house access to a range of journals is at the heart of academic library services. The decision to shift to providing access by paying user fees rather than purchasing materials remains controversial.

Transformational change is undoubtedly the most difficult to undertake. It requires not just a change in the status quo, but the development of a new framework that may bear no resemblance to anything the stakeholders have seen or experienced in the past. They must be convinced not only that the new construct will be an improvement over the existing one, but that it will work at all.

In a *Harvard Business Review* article published in 1995, John Kotter identified eight considerations for the success of transformational change.[1] First, there must be a sense of urgency. This relates to the issue of assessment. There must be a sense that things are so seriously wrong that improvement is not an option and that only a completely new approach will suffice. The need to create a powerful coalition to lead the process is the second consideration. A team consisting of managers and key stakeholders who support the initiative is needed to organize and drive the process. This is especially true during the inevitable periods of high stress and tension.

The third consideration is that there must be a vision that is appealing and easy to understand and communicate. The fourth is that the vision must be adequately communicated. Transformation is extremely difficult, and it is not possible unless most of the stakeholders are invested enough in the change to make individual sacrifices. A concise, compelling statement that portrays an improved end-state must be developed, and it must be communicated widely and often.

Fifth, obstacles to the vision must be removed. They may include existing organizational structures or processes or individual behaviors. There needs to be a mechanism for identifying these barriers as they emerge and for dealing with them. This is true especially in the case of key individuals who may block progress. Failing to deal directly with their behavior may cause others to question the organization's commitment to the change.

The sixth and seventh considerations relate to managing results. It is important to plan for short-term wins. Because transformational change takes such a long time to achieve, it is critical to identify short-term accomplishments to maintain morale and momentum. On the other hand, declaring victory too soon can lead to failure. It is important not to confuse the incremental improvements that are likely to occur during the process with the end-state itself. Unless the process is completed, and these initial changes are embedded in the

1. John Kotter, "Why Transformational Efforts Fail," in *Harvard Business Review*, March / April, 1995, 59-67.

long-term construct articulated by the vision, they are just as likely to slowly disappear over time.

Related to this point, the final consideration is the importance of anchoring the changes in organizational culture. Linking new behaviors to improved performance is one way of demonstrating the value of the efforts. It encourages everyone to continue operating within the new framework until it becomes habit and "the way we do things around here." It is critical to ensure that new managers, whether they are promoted from within or hired from outside, are committed to maintaining the new operational framework.

Conclusion

Over the past 20 years, higher education institutions and academic libraries have become better at employing effective management practices. Academic libraries have become more adept at using group processes such as task forces and teams to develop and implement new programs, as well as to manage ongoing operations. They recognize the importance of involving a broad range of stakeholders and building consensus for the change required and the most appropriate means for achieving it.

Talking about change has, to some degree, become hackneyed and trite. In fact, each new change initiative should be seen as an opportunity to increase individual and organizational capacity to engage in change. The discussion is no longer about whether there should be change, but how best to identify what needs to be done or done differently, and how best to do it.

Some of us are change agents and thrive on change. Many of us might be just as comfortable with a status quo that lasted more than a day or two. Certainly, life would be easier if the job and how it is accomplished were not constantly in flux. In *The Inventive Organization*, Jill Janov talks about change leadership as anticipating where change will occur and having the resources ready when it gets there.[2] Projects such as CLIR's case studies on technical innovation will help us to understand what those resources are and how best use them.

2. Jill Janov, *The Inventive Organization*, (San Francisco: Jossey-Bass, 1994), 290.

Strategies for Successful Change:

Lessons from the American Council on Education and W. K. Kellogg Foundation Project on Transformational Change

Barbara Hill

In 1994, the American Council on Education (ACE) and the W. K. Kellogg Foundation (WKKF) formed a partnership to help colleges and universities succeed with comprehensive or transformational change—a deep and pervasive type of intentional change that affects the institution as a whole rather than its discrete parts. In considering the nine case studies that follow, it is useful to draw on the findings of this project, which offer a number of strategies that have contributed to successful change.

ACE and WKKF selected 26 institutions of all types to participate in a project to help them identify, clarify, and address their own agendas for change. The project targeted institutions that sought to undertake a comprehensive change agenda rather than to solve discrete problems through isolated solutions and strategies. It also aimed to engage the institutions in an examination of their current approaches to leadership and decision making and to encourage them to experiment with new forms of both. A list of project institutions and the topic each selected appears on page 9.

The project focused both on substantive change themes and on change processes. Examples of the former included improving teaching and learning, redefining faculty roles and rewards, and determining new curricular priorities. Change processes included such issues as the role of leadership throughout an institution, dilemmas caused by underlying values and assumptions, and the need to create a climate of trust and civility.

The project was based on the following assumptions and values:

- Shared leadership is essential to institutional change.
- Teamwork and coalition building are central to the change process.
- Comprehensive and enduring change starts with conversation.
- All participants in the change process are learners.

Barbara Hill is a senior fellow in the Center for Leadership Development and International Initiatives of the American Council on Education.

Project on Leadership and Institutional Transformation
Participating Institutions by Change Theme

Faculty Roles and Rewards
- Kent State University (Reconceptualizing Faculty Roles and Rewards)
- Knox College (Reconfiguring Faculty Roles and Rewards)
- Portland State University (Developing Faculty for the Urban University of the 21st Century)
- Stephen F. Austin University (Revitalizing Faculty, Staff, and Administration)

Creating a Learning-Centered Institution
- The City College of New York (Maximizing Student Success)
- Maricopa County Community College District (Achieving the Desired Learning Paradigm)
- Michigan State University (Enhancing the Intensity of the Academic Environment)
- Valencia Community College (Becoming a Learning-Centered College)

The First-Year Experience
- Seton Hall University (Transforming the Learning Environment)
- University of Minnesota, Twin Cities (Improving the Collegiate Experience for First-Year Students)
- Wellesley College (Improving Intellectual Life at the College)

Reforming/Reconceptualizing the Curriculum
- Northeastern University (Academic Common Experience)
- State University of New York at Geneseo (Reforming the Undergraduate Curriculum)
- University of Puerto Rico, Rio Piedras (Reconceptualizing the Baccalaureate Degree)
- Mills College (Strengthening the Two Faces of its Institutional Identity)

Developing Community
- Centenary College of Louisiana (Developing Campus Community for Quality Teaching and Scholarship)
- University of Wisconsin, La Crosse (Building Community: An Institutional Approach to Academic Excellence)
- University of Arizona (Department Heads: Catalysts for Building Academic Community)
- El Paso Community College District (Managing Change in a System of Shared Governance)

Institutional Culture
- Olivet College (Creating a Climate of Social Responsibility)
- University of Massachusetts Boston (Improving Through Assessment)
- Bowie State University (Creating a Transcending Institution)
- College of DuPage (Creating an Environment of Change)

Enhancing Teaching and Learning Through Technology
- California State Polytechnic University, Pomona (Enhancing Learning and Teaching with Technology)
- University of Hartford (Planning and Managing Technology as Part of Teaching and Learning)
- Ball State University (Defining, Refining and Implementing the Teacher-Scholar Model in a Technology Environment)

- Faculty and administrators must form new alliances to succeed at change.
- Those who have been left out of the process because of their position in the institution, or their race, ethnicity, or gender must be included.

The findings from the ACE/WKKF project broaden and deepen common understanding about how intentional change occurs. They do not refute typically held views that vision, leadership, and commitment are central, but refine them by adding nuance and detail.

Insights

The insights offered here come from three sources. First, project consultants conducted biannual campus visits and held monthly phone calls with campus leaders. Second, representatives from the 26 institutions reflected on their experiences—their successes and frustrations—in a series of reports and at four project meetings. Finally, many institutional leaders gave presentations at national meetings and wrote articles and reports about their experiences with change.

Over their engagement with the project, institutions that were consistently purposeful and reflective about change developed new behaviors and strategies that could be used again and again. Colleges and universities that learned from their experiences found new ways to respond to the challenges of their environments and developed new capacities with which to face the future successfully. Two fundamental insights emerged from their experiences.

First, change leaders were guided by the recognition that change is not an event, with a beginning, middle, and comfortable end point. Rather it is an ongoing, evolutionary process, where one change triggers another, often in unexpected places. This interrelationship of the components leads to an endless cycle of reassessment and renewal. No wonder change leaders often worry about the dangers of burnout for the key players and the anxiety that occurs when people realize that real change means there is no point when everyone can declare a victory and go back to normal life. As one provost put it, "Now that we have been through this incredibly difficult period of restructuring and program realignment, how do I tell the faculty that the next big change is already upon us?"

The second understanding, related to the first, is that comprehensive or transformational change requires holistic and integrated thinking about the institution. Rethinking undergraduate education is not just about changing course content or course offerings. It requires new approaches to student services, faculty development, assessment, and links to the community. While no institution can address everything at once, the awareness that change triggers more change is an essential conceptual tool for leaders.

The combined experience of the 26 participating institutions points to a number of strategies that contributed to success as they sought to make major changes on their campuses. The first series of insights into the successes concerns actions that institutions take,

that is, factors they can control to bring about success. The second series relates to context, or the uncontrollable characteristics of the external or campus environments that facilitate or impede change. These insights show that while intent and strategy are essential, not all factors associated with the change process can be controlled. Institutional history, as well as external forces and events, may thwart a well-designed and well-executed change initiative.

Intentional Strategies

The following is a chronology of actions for implementing successful change exemplified in the experiences of the institutions participating in the ACE/WKKF project.

Leaders make a clear and compelling case to key stakeholders about why things must be done differently. Institutional leaders who succeed with change initiatives clearly articulate why it is necessary and why current approaches no longer work. These leaders realize that key constituents must recognize the necessity for action before they willingly participate. The proposed change must address something considered important—such as the experiences of students or the faculty's professional lives—a *better* future rather than simply a different one.

Institutions struggled when leaders failed to garner interest in and support for change. In these cases, the agenda was usually identified by a small coterie of administrative leaders, typically with insufficient faculty input. The change initiative seemed detached from the concerns of the campus—a solution in search of a problem, or change for the sake of change. Change agendas did not generate enthusiasm if they were not meaningful to those affected by them or those expected to carry them out.

Change leaders craft an agenda that both makes sense and focuses on improvement without assigning blame. To be successful, a change agenda must make sense to those on campus and, at the same time, challenge values and practices that are no longer working. Successful change agendas are also framed so that they do not assign blame. Change often threatens those who interpret the need for change as an indictment of their current or past knowledge, competence, or performance—a judgment that strikes them personally and deeply. Leaders of institutions that made progress crafted their agendas for change in terms of a better future and an improved institution without making people feel attacked or diminished.

Several institutional leaders began crafting change agendas by articulating the pressing issues as a series of questions without prematurely selling "solutions." This approach fostered the campus community's desire to be involved in constructing responses and devising solutions. The questioning process led to a collectively crafted vision of the future that excited all participants. Thus, a curriculum change began with the question, "What should a graduate of this institution know and be able to do?" The process of forging agreement on the solutions both harnessed creativity and developed widespread ownership for the resulting change agendas.

Change leaders who framed concerns as a set of solutions to be implemented often had difficulty gaining support from faculty for the change initiative. On most campuses, individuals tend not to see the same problems, let alone the same solutions. Without a process to discuss the problems in depth and tap into the creativity and intelligence of the community in generating solutions, change initiatives rarely get off the ground.

Change leaders develop connections among different activities and individuals across campus that create synergy and provide momentum for the initiative. Comprehensive change, which is both broad in scope and deep in impact, consists of a series of discrete, related changes that, when joined together, lead to large-scale change. A key to successful change for many participating institutions was finding and creating linkages among various activities occurring on their campuses.

Connections and linkages within each institution help create and sustain the energy required for a long-term investment in change. On many campuses, multiple change initiatives provided an important range of opportunities with which numerous individuals could become involved. Additional energy was created because multiple projects facilitated new connections among individuals from different parts of the institutions. These new connections, in turn, led to fresh conversations that generated original ideas and strengthened shared purposes.

At the same time, successful institutions look outside themselves—through connections to other institutions, funding agencies, and national efforts—to provide the impetus to undertake a change initiative, enhance its legitimacy, and generate momentum to continue the efforts. Understanding how issues at a particular institution are tied to those of higher education in general—regionally, nationally, and internationally—helps leaders overcome the insularity that impedes movement.

Senior administrators support and are involved in institutional efforts. Successful change requires active participation by those with authority over budgets, personnel, and institutional priorities. Otherwise, change efforts do not receive the needed resources and generate nothing more than frustration. The support of the president or provost, both in word and in deed, is critical.

Successful change leaders recognize windows of opportunity created by everyday events and capitalize on serendipity, taking action or making decisions to move the change agenda forward. They facilitate progress on their change agenda by constantly focusing the attention of the institution on it—by regularly attending key meetings, setting agendas, allocating resources, and constantly sending messages that the change initiative is important. By paying attention to opportunities to effect change over the course of a typical week, leaders find small levers for change, which accumulate for a large impact over time.

The participating institutions that made progress had active, involved leaders who took visible risks to reinforce the importance of the change initiative. They made both financial and human resources

Not all factors associated with the change process can be controlled. Institutional history, as well as external forces and events, may thwart a well-designed and well-executed change initiative.

available. They removed institutional barriers and provided opportunities and structures through which the campus community could constructively cope with its fears and frustrations.

Collaborative leadership identifies and empowers talent across campus and at a variety of levels. The energy required to make progress on intentional change is not limited to senior administrative leaders, but rather taps into the capacities of many different individuals; leadership by the faculty and mid-level administrators is critical. Individuals throughout the campus who have stature, skills, talent, and credibility can help lead the change initiative by formulating and implementing a shared agenda for change. They can shape collective opinion, use their expertise to address a variety of institutional issues, and give credibility to the process and the products they helped to create.

Participating institutions used a variety of approaches to identify leadership talent throughout their institutions. Some used traditional means, such as relying on key institutional administrators, identifying leaders of important faculty committees, or selecting successful department chairs. In other institutions, key opinion shapers were asked to identify other campus leaders whom they admired. Those individuals, in turn, were asked to identify additional leaders, creating a large pool of potential collaborators. Another group of institutions invited everyone interested to participate and, over time, identified leaders from among the group of energetic volunteers.

Leaders develop supporting structures, create incentives, and provide resources for change efforts. Successful institutional leaders realize that a change initiative depends on a variety of structures, processes, and resources to facilitate and support it. Institutions can use a range of incentives to motivate key individuals to commit time and energy to the change process, including summer salaries, computer upgrades, conference travel money, and public recognition.

Institutions that made progress on incorporating technology into teaching practices provided easily accessible computer training for faculty members; they created processes to simplify the acquisition of hardware, software, and technical advice; and they offered curriculum development workshops. By removing barriers and creating supporting structures, these campus leaders facilitated the adoption of new technologies. These opportunities also were flexible so that faculty could adopt new techniques in ways that met specific needs. Successful leaders did not force a "cookie-cutter" approach.

Leaders focus campus attention on the change issue. To be successful with change initiatives, change leaders must resist getting engulfed by the turbulence that occurs in every institutional system and must keep the campus focused on the issues at hand. Through the cumulative effect of a variety of tactics, some of which have been described earlier, they minimize distractions that quickly consume energy, demand attention, and thus derail the change efforts. They refer to the change agenda using consistent language and symbols in public presentations and make it part of everyday conversations. They use e-mail and the Web to communicate broadly about deliberations and

results of project meetings and activities. Successful leaders also develop incentives for various individuals throughout the organization to incorporate the change agenda into their work. They endorse projects on campus related to the larger issue. They hold campus symposia, create faculty development activities, and sponsor nationally prominent speakers to focus campus attention.

Successful institutions do not rely on a single approach or make the change initiative solely the responsibility of one group. Rather, they recognize that the initiative is substantive enough to create multiple opportunities for various groups to work as partners. In addition, they do not allow new issues to steal attention.

Institutional change leaders work within a culture, while challenging its comfort zone, to change the culture. To make progress on a change initiative, an institution develops ways to operate paradoxically: changing its culture in ways congruent with its culture. Doing this may seem implausible, but institutions succeed at this difficult task when they understand how their culture works so they can intentionally create effective strategies. The change process must be compatible with an institution's own cultural norms and standards or it appears illegitimate and inappropriate, and, in the end, is ineffective.

Successful institutional leaders use methods viewed as legitimate for identifying individuals to be members of change teams because they cannot impose a method inconsistent with campus patterns of participation and decision making. They recognize that violating the traditions and structures of campus-wide decision making dooms change efforts to failure.

Leaders plan for change over the long term. Achieving comprehensive, intentional change is a long process, and successful change leaders develop strategies that capture and hold attention over many semesters and through distractions. For many institutions, this means spending time laying the groundwork for change. For example, some leaders looked at change in terms of a four-year cycle, which is how long it takes a new cohort of students to "live" through the changes completely and to have all students under a common, and new, system.

By recognizing that planning for long-term change requires different assumptions and strategies than short-term change, campus leaders also weigh the effects of particular strategies, rejecting those with only short-term returns that can potentially derail the change efforts later. They choose not to fight some battles or to modify their time frames. They realize a short-term mind-set may do more harm than good, and thus they prepare for and understand the consequences of long-term change.

Environmental and Contextual Factors

An institution's potential success or failure with a change initiative does not depend solely on the strategies it uses. Its historical and external contexts are critical as well. Below are three factors that significantly affect institutional change efforts.

Institutions have a climate of goodwill. The work of change in the academy is collective, and the bedrock of collective action is goodwill and trust. This climate exists when individuals believe that others are acting in good faith, that they themselves are heard, that information is not being hidden, that they are free to draw their own conclusions rather than be told what to think, and that individuals can be trusted to do what is best for the institution. Institutions with goodwill are places where a critical mass of faculty believes that administrators are not interested only in the bottom line or in advancing their own careers, but are concerned with teaching, learning, and research. While mistrust is frequently attributed to relationships between faculty and administrators, it also characterizes some relationships among faculty and among administrators. A climate of goodwill is created over time; it is the by-product of effective relationships and productive conflict resolution.

Participating institutions that made progress with change had sufficient goodwill to overcome the mistrust that characterizes many campuses. At these institutions, administrators generally believed that faculty were concerned about institutional well-being beyond their discipline's boundaries. Institutions that told success stories about a climate of goodwill spoke of abundant communication, the free flow of information, and genuine participation. Some participating institutions that did not have a history of goodwill spent much time and energy working to create a climate of trust.

Institutions have favorable external environments. Environmental stress affects an institution's ability to succeed with change. On a continuum with three broad categories—low stress, medium stress, and high stress—institutions in the middle have the most favorable environment in which to create intentional change because a moderate amount of stress creates an impetus for change without being disabling. Institutions in low- and high-stress environments also can make progress, but more slowly or with more difficulty.

Institutions in low-stress environments must develop strategies to generate energy for change. For example, leaders in these institutions must work to make a compelling case for why the status quo is not acceptable. At the other end of the continuum, institutional leaders in high-stress environments must find ways to deflect externally generated static to make progress on their change agendas. In these institutions—with new problems constantly arising or old ones recurring—leaders have the additional challenge of acting as a buffer against outside stresses so that the institution can concentrate on the desired change.

Leaders stay long enough for the change to take hold. Institutions that make progress benefit from consistent leadership, both from senior administrators and from others throughout the campus. Leaders who stay provide sustained support for the change initiative, reinforce the importance of the change initiative, and are in a position to keep campus attention focused over the long run and to provide a continuous stream of resources. Most important, they provide con-

sistency during the process and play the important role of championing it.

Leadership turnover is often a decisive factor in institutional success or failure. Many participating institutions experienced changes of presidents, provosts, or key faculty at critical points in the change process. Those that continued to make progress in spite of turnover were characterized by leadership at many levels of the institution. When many individuals on campus become the champions of change—a result of purposefully involving new cohorts of potential leaders—wide ownership of the agenda drives efforts forward, beyond the tenure of any single administrator or faculty leader.

Leadership turnover is not something that can be commanded or controlled; leaders leave for numerous reasons. Yet the timing of a leader's departure is critical. When a change initiative has not had time to develop a wide base of support, the departure of a key leader is likely to stall or sink the process. Some institutions facing a leadership transition can continue their efforts—in some cases, almost without interruption—because they have developed momentum based on widespread leadership: The initiative does not rest with one person or even a small cohort of leaders.

Conclusion

Although these insights comprise neither a twelve-step program to institutional transformation nor a guarantee of success in future change initiatives, their power lies in their associated lessons of intent and reflection. No matter how many "successful strategies" an institution employed or how well the strategies were executed, the success of each initiative was linked with three habits of mind displayed by the change leaders:

- They were *intentional* in their actions. Change was an act to be managed, not a happenstance to be endured.
- They were *reflective* on their change endeavors.
- They *learned* from their actions and adjusted their plans. Their change agendas were dynamic, not static, suggesting that the strategies and behaviors that were learned could be used again and again, giving them new ways to respond to the challenges of their environments.

The early results of the ACE/WKKF Project on Leadership and Institutional Transformation demonstrate that institutions of higher education can change successfully in pervasive ways. The experiences of the 26 institutions indicate that change is both complex and surprising—positively and negatively—and, at the same time, that the intentional pursuit of the successful strategies outlined here can lead to meaningful, thriving, and comprehensive change.

A Dozen Thoughts to Stir the Pot

Brian Hawkins

Incremental change on college and university campuses, no matter how desirable, is not possible, as Patricia Battin and I argued in *The Mirage of Continuity:*

> For the past two decades, libraries and computer centers have radically altered both themselves and the higher education landscape, albeit in an incremental fashion. True transformational change continues to be constrained by the misguided belief that the technological revolution can be contained within the old organizational structures. Succumbing to the mirage of continuity that denies the need for financial and management reorganization and the belief in a technological panacea that will miraculously transform an historic tradition of knowledge creation and transmission by the simple substitution of digital for analog technology will only increase dysfunction and paralysis. To recognize the new conception of the library is to recognize and accept the inevitability of a new conception of the university.[1]

The preceding presentations and the case studies have informed us about several projects and plans for making change, but I want to challenge conference participants to consider twelve ideas meant to stimulate debate, "A Dozen Thoughts to Stir the Pot."

1. Transformation is inevitable, as the current system is under pressure that makes an incremental approach futile.

2. Scholarly communication has not yet been substantially affected by information technology, and that is part of the problem.

Brian Hawkins is president of EDUCAUSE.

[1]Brian Hawkins and Patricia Battin, eds. *The Mirage of Continuity: Reconfiguring Academic Information Resources for the 21st Century,* (Washington, D.C.: Council on Library and Information Resources and Association of American Universities, 1998), 5.

3. The self-contained college library is not sustainable, economically or intellectually.

4. In defining transformational change, learn from the Euro! It seemed impossible for European countries to give up their individual currencies, but when the perceived value of collective action was great enough, they made the transition.

5. Information technology costs have been an add-on expense because there has been no substitution or replacement.

6. Budgetary silos are killing us. We need to understand new units of analysis and use them to define solutions.

7. Information technology is no longer a choice, it is a competitive mandate.

8. The issues of assessment and cost-benefit analysis are a conundrum for both information technology and higher education in general.

9. The roles have blurred between libraries, information technology organizations, and other information service providers and, therefore, we need new structures and budgetary approaches to leverage change.

10. To introduce change successfully, one must be an anthropologist, trying to understand and interpret different cultures.

11. Technology must not define the institutional mission.

12. Beware the adage, "If you have a hammer, everything looks like a nail."

The old ways of thinking about independent roles for the library and the computer center are not only counterproductive, they are also impossible to sustain. As university and college administrators look for ways to curtail spiraling costs, they cannot expect to make line-item budget cuts. Instead, they must work with members of the campus community to reconceptualize the work to be done and the methods of doing that work.

The scholarly communication process affects the entire institution, and it is certainly not merely a "library problem." As changes are made in the way knowledge is generated and transmitted, inevitable changes in the promotion and reward system for faculty will also occur. Universities will, out of necessity, rethink their institutional policies about intellectual property rights. And the effects of these changes are so big that institutions must plan for the new organization, rather than tinker with parts of the old.

Colleges and universities have not been especially good at assessing the costs and benefits of technology, but for universities to realize maximum benefits, we must be able to show that technology leads to real improvements in educational outcomes.

Information technology, while promising a great deal, has thus far been additive rather than transformational. Too many instances can be cited of colleges and universities bearing great costs to use technology to do the traditional work of the institution. It is important that administrators carefully consider how technology can be used to do things in an entirely different way. How can technology be used to help make a faculty member more productive, for example? What part of the faculty member's work can now be done through the Web, leaving more time for discussion and critical assessment in the classroom? Colleges and universities have not been especially good at assessing the costs and benefits of technology, but for universities to realize maximum benefits, we must be able to show that technology leads to real improvements in educational outcomes.

Students and their parents have come to expect information technology, so it is no longer an investment option for colleges. The challenge is to use the technology effectively—to enhance the institutional mission. Distributed and distance learning are obvious areas where technology can be enormously helpful, but there is a great deal of competition from the corporate sector in this area. Corporations are likely to develop educational programs in highly sought-after fields—such as business—that can be offered at low cost to high volume markets. Will this leave only the more specialized—and more costly—courses to be offered by universities?

We must stop thinking about the library budget or the computing budget, and instead focus on the most effective deployment of the institution's information resources. Compartmentalized budgets that are the norm in higher education do little to stimulate transformational change, so we must find new financial models that facilitate new ways of supporting the broad educational mission.

To implement comprehensive changes, each of us must become an anthropologist, that is, one who seeks to understand and interpret the different cultures represented by different campus groups—faculty, librarians, and information technology staff. Collaborative problem-solving and planning are necessary so that the best of each community's thinking can be brought to bear on reinventing the college's or university's information services. Since change is no longer a choice, collaborative creation offers the best chance for successful institutions of higher education.

Discussion and Recommendations to CLIR

The foregoing presentations stimulated discussion that ranged from how colleges are incorporating technology most effectively to related issues of what is needed to develop new modes of scholarly communication, to protect intellectual property, and to assess the value of the residential college experience. Developments in information technology are already pushing institutions to think creatively about these issues. In that context, participants made the following observations about the role of the library:

- The scholarly communication structure itself must change before many other changes can take place. Faculty and the scholarly societies must be instrumental in changing that structure. Librarians are making modest efforts to change the relationship between libraries and publishers, but much more needs to be done to engage faculty and their professional associations in consideration of necessary changes in scholarly communication.

- Technology gives librarians the means to become partners in the educational process, and this is a powerful new role for college libraries. One librarian described the ability to use videoconferencing to bring an author into the classroom to discuss his or her work. Making this discussion happen involves the faculty member giving the course and the librarian who knows how to use the technology.

- Not every problem is solved by technology. As librarians begin to collaborate more effectively with the teaching faculty, they will quickly realize that each of the disciplines has different information needs. Librarians and information technologists need to have systems in place that serve these diverse needs. They must not insist that "one size fits all."

- The special role of the residential college must be examined. One participant reminded the group that transformation does not necessarily mean converting all information resources to electronic form. Residential colleges frequently advertise themselves as a community of learners. But in the Web environment, there is a world community. So it becomes necessary for the college to think carefully about its institutional mission and then decide how technology can help it fulfill that mission. Perhaps it is the strength of the residential college experience that is transformative. New ways must be found to assess learning in the context of the college. There are ways of learning without coming to a special place. This raises the question, why will someone want to come to a campus? Perhaps one reason is that knowledge is more difficult to gain than information. Knowledge involves developing a framework of meaning—perhaps done best in a physical learning community. Technology has brought this issue to the fore, but technology is not a solution. It only forces us to ask the right questions.

Recommendations to CLIR

Participants were asked to consider what steps CLIR should take to support the library and its staff in planning and carrying out effective change.

- CLIR should work to clarify the image of what a library is and what librarians are: managers of information and intellectual inquiry. The profession is changing more than the awareness of the profession is changing. It is in danger of no longer attracting bibliophiles. At the same time, many of the younger recruits to the profession come with extensive technical background, but little understanding of how future-oriented the profession is. Mature professionals might be selected to link up with library schools to nurture next-generation librarians. CLIR might help develop a practical guide for universities on how to recruit a university librarian.

- CLIR should convene a group of presidents, provosts, and librarians to discuss technology and change as it has been discussed in this meeting, possibly in collaboration with the American Council on Education.

- CLIR should convene groups of faculty members by discipline on a regional basis to discuss how they are using technology in the classroom. That would begin to build a base of knowledge across regions and break down some of the isolation.

- CLIR should devise strategies for faculty to collaborate with librarians and information technology professionals. It might be most useful to work with consortia or selected groups of colleges.

- CLIR could develop standards for assessment of college library services and programs. It could help identify what could best be done nationally and what locally, sorting out the proper domain for different issues.

- CLIR should issue publications with messages aimed specifically at provosts and presidents. Many CLIR publications are good for librarians, but are not read by top administrators.

Part II

Case Studies

California Institute of Technology, the Sherman Fairchild Library

A New High-Tech Library

http://www.library.caltech.edu

BACKGROUND

Located in Pasadena, the California Institute of Technology (Caltech) is a small, coeducational university dedicated to exceptional instruction and research in engineering and science. The student body is composed of 900 undergraduate and 1,100 graduate students who maintain a high standard of scholarship and intellectual achievement. With an outstanding faculty of about 300, including several Nobel Laureates, and such off-campus facilities as the Jet Propulsion Laboratory, Palomar Observatory, and the W. M. Keck Observatory, Caltech is one of the world's major research centers.

The Caltech Library System was founded in 1891 and currently has a staff of 61. The library's holdings include 550,325 book titles and bound periodicals, 543,000 microforms, and a selective U.S. Government publications depository. The library consists of two central facilities: (1) the Millikan Library, housing Millikan collections and Library Administration, Circulation, Document Delivery Services, and Technical Processing; and (2) the Sherman Fairchild Library of Engineering and Applied Science, housing the engineering collections, the Library Information Technology group, and the Digital Media Center. The Sherman Fairchild Library was dedicated in January 1997 and has a staff of one director, three librarians, and three support staff who serve 85 faculty members, 400 graduate students, and 325 undergraduates. In addition, the Sherman Fairchild Library houses the five information technology staff members for the whole library system. The director of the library is also responsible for all science and mathematics library services and staff in other locations on campus. In addition to Millikan and the Sherman Fairchild, the library system includes five branch libraries: Astrophysics, Geology, Public Affairs, Earthquake Engineering, and Management.

Funded by a $9.6 million gift from the Sherman Fairchild Foundation, the Sherman Fairchild Library was created to meet a need, perceived by both faculty and library staff, for increasingly complex and expensive electronic resources. The engineering collections were housed comfortably in a number of departments—they were, in effect, department libraries—but to offer electronic resources to users in the most cost-effective manner, the libraries needed to be consolidated.

THE PROJECT

The Process

Planning for the library began long before the groundbreaking ceremony in March 1995. In 1988, the head of Caltech's library committee and the librarian realized that the university needed to consolidate its collections to provide additional information resources. No money was available at the time, but when the Sherman Fairchild Foundation expressed interest in making a gift (continuing a long history of donations to Caltech), the idea for the new library was presented and accepted. A planning committee of engineering faculty and librarians was formed, and together they articulated what the library was to achieve. Brad Sturtevant, Hans W. Liepmann Professor of Aeronautics and chairman of the committee, led a consulting process that relied on heavy input from the computing center staff. The recommendations ultimately persuaded six academic departments, with collections in seven different sites, to consolidate their resources and give up the convenience of their local libraries.

Library staff members described Sturtevant as the moving force behind the creation of the Sherman Fairchild. It was clear from their comments and those of faculty members that a shared vision of what the Sherman Fairchild could do for the work of Caltech, a vision that Sturtevant ably and energetically advanced among all constituents, was critical to his success. The planning committee took a broad view of the library needs, rather than focusing more narrowly on the applied sciences. A key decision during the planning process was to develop the plans for the library that Caltech needed, even though the estimated cost exceeded what the Foundation said it was willing to give. In the end, the Foundation, persuaded by the vision of the new library and the planning process, provided full funding.

The committee agreed on three main objectives for the library:

- to consolidate the resources of six engineering departmental libraries to exploit new technological advances in information delivery;
- to maintain the responsive service that the former departmental libraries had traditionally provided to engineering faculty, students, and staff; and
- to provide an aesthetically pleasing environment conducive to productive study and research in engineering and applied science.

At first, many faculty members were unconvinced of the need to consolidate the libraries and feared the move would compromise the responsive service they relied on. The libraries had been convenient-

ly located within the departments and, understandably, many staff members resisted the idea of having to travel any distance to use their libraries. Here the leadership of the library faculty committee proved critical to advancing the project.

The toughest part of the process for the planning committee was gaining the support of the faculty, who seemed to feel that nothing was broken and so nothing needed to be fixed. But most faculty members now agree that the Sherman Fairchild is a boon to Caltech. This is because the library staff has been largely successful in providing the additional resources the faculty wants with the same quality of service as before. The planning committee secured a guarantee that staffing levels of subject specialists would stay the same for three years, and the Sherman Fairchild Library continues to be staffed with librarians with expertise in the diverse fields represented in the Engineering and Applied Science Division.

Another reason the library is regarded as successful is that the architects were able to meet the third objective—creating an aesthetic and inspiring environment—despite great difficulties in shrinking the desired building program into the space available. After agreement about building plans was reached on campus, the librarians struggled with the timing for decisions about technology. Kimberly Douglas, Director of the Sherman Fairchild Library, explained that they "held back on decisions long enough to get the latest technology and yet open the facility on time."

The completed Sherman Fairchild Library is a 29,540 square-foot structure designed by the architectural firm of Moore Ruble Yudell of Santa Monica. The design, influenced by the work of Bertram Goodhue and Myron Hunt, reflects a fresh, appreciative interpretation of Caltech's architectural tradition. At the same time, the building has the infrastructure to support the substantial technological needs of the facility. The library has 100 study spaces with laptop ports (of which 50 are currently live), 18 seated workstations, and a number of lounge chairs. Two floors (ground and second) are outfitted with compact shelving, motorized with optic safety sweeps and aisle access controls. The facility accommodates 48,960 volumes of monographs, 46,656 volumes of bound journals, 67,500 volumes of technical reports, 5,616 volumes of reference materials, and 760 titles of current journals.

Technological and Service Innovations

A multimedia classroom, which also serves as a conference room, contains a modular presentation system. For the audience, the focus of this system is a 70-inch rear-projection television screen. The image on this screen is controlled by the speaker from a touch-screen controller installed in a speaker podium. From this screen, the speaker controls a video recorder to play back (and record) videotapes, a slide-to-video converter to project slides onto the TV, and a document camera to project written and printed material. The different

sources can even be mixed. In addition, the modular presentation system is integrated with a two-camera video-conferencing unit.

The library staff decided it was crucial to provide users with technologies that allow them to take data with them. As a result, the Sherman Fairchild Library has numerous scanners, beginning with the Minolta EPIC 3000 book scanner. The library also offers several flatbed scanners like the HP ScanJet 4c, which scans in 24-bit color images at a resolution of up to 600 dpi. After two years, the original Minolta scanner was moved to a staffed service point where its capabilities could be better exploited.

Eight laptop computers are available to faculty members, students, and staff to check out from the circulation desk. A significant investment in improved access to online resources, they may be used in the library up to four hours at a time. Groups may request the use of up to four of these laptops. More than half of the seating in the Sherman Fairchild Library has active network connections and power. The remaining seats all have power, and network cable has been put in place throughout. Only the network system would need to be expanded to give online access to all the seats in the Sherman Fairchild Library.

RESULTS

Interviews with a variety of users confirmed a high level of success with the three objectives that the planning committee articulated. Students from several departments noted that the consolidated libraries are actually more convenient for their research than the departmental libraries were. While they would prefer more study rooms, they appreciate the new, inviting atmosphere and the abundant technology. The students mentioned the value of centralized access to print materials and some expressed interest in more print resources, especially reference works.

Faculty members report that they continue to experience excellent service from the new facility. Some even conceded improved access. One faculty member in applied mathematics attributed some of the increased use of technology in classes to the establishment of the Digital Media Center. This center, located in the Sherman Fairchild Library but staffed by Information Technology Services, provides a central resource for the exploration, creation, and use of digital media and interactive technologies.

The role that the Sherman Fairchild plays within the Caltech community underscores how well the planning committee identified its three main objectives. When asked how important the library was to their work, some faculty members said that they didn't use the library because all the information they need is accessible from their desktops. Of course, they understood that it was the library that had acquired and made available much of what they use at their desks, and they continue to think of the library staff as key resources. There were also those who said that they like going to the Sherman Fairchild to read because of the sheer attractiveness of the building and

What has made Caltech a successful innovator in technological integration is the way it has forged productive partnerships with all the stakeholders in information resources. Though well-funded, the institute was faced with a problem that could not be solved by money alone.

the pleasure of working in "a scholarly environment." Several admitted that the aesthetic appeal of the library had done much to win them over. The fact that their relationship with specialist librarians—"the people who know their business"—had survived the transition intact was also mentioned as key to the new library's reception in the community. Students, on the other hand, were quick to praise the library as a place to gather and as a place to use the print and electronic resources vital to them.

The newly consolidated collections leave the Caltech library staff well-positioned to serve a scientific and engineering community whose needs change rapidly. Caltech is not a highly centralized academic culture, and many library collections have developed within a single discipline. But as the nature of science itself changes, so do the tools that scientists use to discover. Certain groups of scientists at Caltech, such as those working on fluid dynamics or air pollution studies, had been disadvantaged by the specialization of the departmental library system. The ability to find a variety of resources in a central location is a boon to those working at the borders of older, more traditional disciplines. The Media Center, in particular, is designed to meet the needs created by the radical new ways that science is carried out and promotes cross-disciplinary research. Although this facility is not a training center per se, the focus is on meeting the research and teaching needs of the faculty. Here they can get help with presentations, developing curricular materials, and prototyping and test bed services.

Library staff were pleased that they were able to provide their clients with the resources they need, but also noted that the expectations of their patrons have grown accordingly, and this places high demands on the staff. However, they seemed to be comfortable with the fact that the students are often more technologically sophisticated than they are.

The original vision of those who created the Sherman Fairchild Library was that the new technologies would extend to the entire library system and the research programs it supports. That vision has largely succeeded. As noted by Vice Provost David Goodstein, responsible for both the libraries and information technology services, the Sherman Fairchild has given Caltech the leverage for building an infrastructure for the delivery of information resources campus-wide. The Millikan Library is now scheduled for technology upgrades, modeled on those of the Sherman Fairchild. The vice provost has expressed his commitment to building on the investment of the Sherman Fairchild to spread these new library services across the campus. University Librarian Anne Buck recently appointed a new member to the library team, Eric Van de Velde, director of library information technology. A respected scientist himself, Van de Velde brought much credibility to the position. His appointment is viewed by faculty and library staff alike as a significant sign of Caltech's commitment to providing faculty and students with the information resources they need.

Library staff members are already developing a digital library infrastructure for Caltech, and they believe that the Sherman Fairchild Library provides an excellent base on which to build. They are pleased to have a new level of technological integration that makes their own work easier. They are aware of the faculty's expectation that they will set standards for many aspects of the digital library, including how faculty work will be preserved if it is created in electronic formats. Because faculty members at Caltech are highly productive scientists, they are naturally interested in the changes under way in the electronic dissemination of information. The library will be active in publishing and plans to use Web and database technologies to disseminate Caltech research to the widest possible audience.

What has made Caltech a successful innovator in technological integration is the way it has forged productive partnerships with all the stakeholders in information resources. Though well-funded, the institute was faced with a problem that could not be solved by money alone. The chief obstacles to consolidating seven library collections into one were those faced by many institutions: lack of space, many competing interests that claimed precedence over library needs, and the sheer forces of inertia: the natural resistance of faculty, staff, and administration to change. It helped that Caltech is small and its faculty members, students, and staff know each other well. The atmosphere is, as one senior administrator put it, "respectful and unsuspicious."

The ability to think through the problems of delivering new services and to focus on what the library needed to be, rather than what it could afford to be, was an important step in the planning process. As the vice provost said, "The Sherman Fairchild was worth the extra money spent on it."

Carnegie Mellon University

A New Electronic Archives

http://www.library.cmu.edu

BACKGROUND

Carnegie Mellon University (CMU) is a private institution serving an undergraduate and graduate student population of 7,500, with a faculty, research, and administrative staff of 3,000, located in the Oakland section of Pittsburgh. The University Libraries, consisting of the Engineering and Science Library, the Hunt Library, and the Mellon Institute Library, have a staff of 32 faculty members, 56 library employees, and 28 students working full-time, and an annual budget of $6.3 million. The libraries' collections consist of about 800,000 volumes and 250,000 audiovisual materials. Reciprocal borrowing agreements have been established with both the Carnegie Library and the University of Pittsburgh's Hillman Library, also located in Oakland. Motivated by the limited size of its print collection, the University Libraries have made extensive efforts to provide a wide range of electronic resources.

Institutional goals at Carnegie Mellon University emphasize the following:

- delivering distinctive and first-quality education
- fostering research, creativity, and discovery
- using knowledge developed on campus to serve society

Carnegie Mellon University has had a strong technical focus since its founding in 1900. Throughout its evolution, culminating in its merger with the Mellon Institute in 1967, CMU has honored the words of founder Andrew Carnegie: "My heart is in the work." Research lies at the heart of this work, and Carnegie Mellon, a leader in using computer technology in research and education, is recognized as being among the top research institutions in the country. Outstanding programs in computer science, robotics, and engineering have further solidified Carnegie Mellon's technological reputation.

Because of CMU's traditional emphasis on technology, it seemed natural for the Univerity Libraries to assume a stronger position by providing digital services. The libraries had already participated in the Mercury, TULIP, and UMI Virtual Library projects. The subject of

this case study, a project to create the Senator H. John Heinz Archives (referred to hereafter as "the Heinz Archives"), follows the tradition of advancing the libraries' strategic plan, according to University Librarian Gloriana St. Clair. The plan includes the following:

- technical expertise in digital library development issues
- demonstration digital library projects
- exemplary digital instructional programs
- automated reference assistance that students can use remotely
- intuitive, easy to use systems[1]

The Heinz project readily meets three of these five conditions.

THE PROJECT

In 1992, as part of a larger donation to Carnegie Mellon University, Teresa Heinz, widow of the late Senator H. John Heinz III, gave papers from her husband's congressional service to the University Archives. The Heinz family donated the papers to Carnegie Mellon to encourage exploration of primary source congressional archive documents by a broad group of users. At the same time, they hoped the papers would be a focal point for research by the faculty and students of the H. John Heinz III School of Public Policy and Management. While a traditional paper archives would provide the latter opportunity, the broader group of users could best be reached by making the core documents accessible electronically. According to Gabrielle Michalek, university archivist and manager of the Heinz Archives project, Teresa Heinz was also interested in the development of an innovative means of access to her husband's papers. The libraries' staff was called upon to draft a proposal, which received funding of just over one million dollars from the Heinz foundations.

In November 1993, Michalek, along with Charles Lowry, then Carnegie Mellon University librarian, and David Evans, director of the Laboratory for Computational Linguistics, drafted a proposal to develop an electronic archives of the most important of Heinz's papers. The archives was designated HELIOS—the Heinz Electronic Library Interactive Online System. In creating this electronic archives and related interfaces, the planners drew on lessons from the libraries' previous information technology projects.

The Process

Staff across the Carnegie Mellon campus collaborated to develop a model for HELIOS. Continuity of staff was essential to the success of the project. Changes in administration occurred in the offices of both the university president and the librarian during the course of the project, but the University Archives and University Libraries' information technology staff worked to ensure sustained progress. They were supported by university and library administrators.

[1] *Carnegie Mellon University Libraries Strategic Plan*, Gloriana St. Clair, University Librarian, October 5, 1998, 3.

The technological orientation of Carnegie Mellon has been essential to this project's success. Equally important is University Librarian St. Clair's enthusiasm for digital library resources and development. Furthermore, the staff and administration of the University Libraries have embraced the opportunities that technology can bring to their work. The administration has encouraged staff members to look to technology for solutions and alternatives. Collaboration is yet another essential element. The University Libraries work closely with other campus units to find supplemental grants for digital projects. In keeping with their desire to find collaborative solutions to technical problems, the libraries have also become a member of the Digital Library Federation.

The collaborative nature of the development of the Heinz Archives has become the standard for many other projects undertaken at Carnegie Mellon. Three organizations participated in the development: the University Libraries, the Laboratory for Computational Linguistics (LCL), and CLARITECH Corporation, a company that developed and customized software for this project. The latter two groups provided software development expertise, while library staff provided system design leadership and project management.

Heinz Archivist Edward Galloway manually processed 1,200 cartons of materials to identify the structure and composition of the collection. Carton contents included papers, audiovisual materials, and memorabilia. The archivist used previously written guides for developing congressional archive collections. After assessment and selection, the number of cartons to be processed was reduced by half. During this review process, series within the collection were identified, a logical arrangement was developed, and an initial inventory was created. While manual processing of archive materials took place, CLARITECH began work on the graphical interfaces.

Graphical Interfaces

Important issues of preservation, system design, access, and place and time independence were identified. System design focused on the need for different interfaces for scanning, verification, and public access. Access to the collection was enhanced through natural language processing, which was used to develop thesauruses and "find the natural linkages in the large diverse body of the archives to build relational hierarchies among documents."[2] Electronic access allowed the materials to be used at any time from any place.

Not all parts of the system were developed in-house. CLARITECH Corporation, in addition to developing the interface, provided commercial software modules for indexing and retrieval of the HELIOS documents. They included the following:

- CLARIT-NL for robust and efficient identification of noun phrases in arbitrary texts

[2] *The HELIOS Archive: A Proposal for the Preservation and Use of the Professional Papers of the Late Senator H. John Heinz III*, David A. Evans, Michael L. Horowitz, and Charles B. Lowry, November 4, 1993, ii.

- CLARIT-LEX for semi-automatic domain lexicon development
- CLARIT-THES for automatic domain thesaurus discovery
- CLARIT-IR for vector-space document indexing and retrieval
- CLARIT-EQ for automatic higher-order term relationship analysis
- CLARIT-OCR for domain-targeted OCR post-processing and normalization[3]

University Libraries staff were responsible for system design standards and data formats. These were developed to ensure portability and integration of HELIOS with the libraries' existing information system. Experience with other university library information technology projects had shown this to be the most important factor for long-term support. While the encoded archival description (EAD) standard was in its early stages of development, both Galloway and Michalek were aware of its significance. To ensure incorporation of the EAD standard over the long-term, sufficient data were initially included for mapping into the appropriate tags.

Interfaces developed for HELIOS provide access for scanning and verification as well as for public use. The scanning and verification interfaces incorporate much of the hierarchical framework identified for the collection during manual processing. These interfaces were developed to reflect inherent relationships among the documents in the folders.

A series map for the collection provides metadata for scanning processing. Scanning involves identifying the unique characteristics for each document, designating document type, assigning folder numbers, and making subgroup/series/subseries designations. Many of these elements were built into the interface as lists from which operators can select. This streamlines the process while also promoting quality control and consistency of input. Electronic folders hold documents, some of which are designated to bundles, reflecting items stapled or clipped together. Throughout the scanning process, the scanned image appears within the interface to allow visual verification. Image scanning is done in real time, while optical character recognition (OCR) processing of the scanned text is done overnight, extending the usage of system workstations.

Verification of both image quality and accuracy of the OCR conversion is done for primary materials, which are defined as memos, speeches, and correspondence that are at the heart of the congressional collection. Input areas in the interface allow for text correction, as well as the inclusion of notes regarding handwritten annotations or text not captured. The interface highlights indexed concepts to facilitate verification efforts. Document sequencing is also ensured during this process, with the interface allowing the resequencing of pages as needed.

Given the limitations of keyword searches against large text-based resources, the Laboratory for Computational Linguistics developed a "content-based document-processing 'engine'"[4] for the HELIOS system. Along with the CLARIT modules noted previously,

[3] Ibid., 11.

the LCL developed methods to interpret natural language queries from the public interface, streamline analysis of OCR output, and automate topical division creation within the archive. This final feature significantly reduces the amount of manual work for the archivist. The use of the CLARIT modules fosters the relationship between noun phrases identified within the document texts and the natural language queries researchers are expected to use. The Laboratory for Computational Linguistics also developed sets of queries from materials extracted from the archives, as well as suggestions for alternative ways of depicting concepts.

Public Access

Introduction of a Web-based public interface at the beginning of 1998 allowed archivist Galloway to make broader assessments of collection use. Detailed analysis of search behavior is not yet supported beyond calculations of session length, specific actions during sessions (display, browse, new search, where, search), and session origin. Most surprising to Galloway is the high percentage of off-campus use, based on IP address analysis.

RESULTS

The project demonstrated the importance of contractual agreements instead of handshakes. CLARITECH did software development under just such a gentleman's agreement. When CLARITECH was sold in 1997, it stopped supporting the software used at the Heinz Archives. Fortunately, this development coincided with the library's negotiations with a third-party vendor for a new library management system, and the vendor agreed to incorporate significant features from the archives interfaces into its archives module.

According to recent analysis by the University Libraries staff, 75 percent of online catalog and database queries are from users at remote sites. To address a corresponding need for remote reference assistance, a project is being framed to develop an automated help mechanism. Components from the Heinz Archives project, such as natural language processing, may be used in this project. In addition, the project will draw on expertise from other technology departments on campus, such as artificial intelligence and robotics.

The HELIOS project is a good example of how technology is being used to reconceptualize and re-engineer traditional library and archival processes for the benefit of users.

[4] Ibid., 8.

Indiana University/Purdue University at Indianapolis

Librarian-Scholar Collaboration in Learning Communities

http://www.iupui.edu/home/libraries.html

BACKGROUND

Indiana University/Purdue University at Indianapolis (IUPUI) serves a student population of 27,000 from its location on the west side of downtown Indianapolis. The university provides more than 180 academic programs, from associate degrees to doctoral and professional degrees. Courses offered reflect the diversity that joint governance of Indiana University and Purdue University brings. IUPUI is home to the only dental and medical schools in the state of Indiana, as well as the largest law and nursing programs. It sees itself as an urban university having much in common with institutions such as Wayne State University in Detroit and Temple University in Philadelphia. A distinct feature of IUPUI is its relatively decentralized organizational structure, which gives schools a great deal of financial and curricular autonomy. According to the summary of the 1997 IUPUI Performance Report, the university views student learning as its highest priority and is committed to creating a learning-centered environment.

The library has a history of significant in-house technical capability. Because the university is only 25 years old, the library did not yet have the print collections of many comparable institutions. The former university librarian was willing to invest heavily in electronic information and to address numerous local and remote-access issues to compensate for the lack of strong print collections. The library administration has its own programming staff who are well paid and dedicated, and who appreciate the opportunities provided by working with the library. A total of 21 full-time employees work in the library's technology group. These employees have a working relationship with the University Information Technology Services (UITS).

Learning Communities

More than 75 percent of IUPUI students are undergraduates, many of whom are first-generation college attendees. The one-year retention rate for full-time undergraduates is about 60 percent and the six-year graduation rate, though it has risen somewhat in recent years, is only 27 percent. The challenge to help undergraduates assimilate and embark on a college career is daunting. A year ago, the university organized a new unit, University College, that provides a common gateway to the academic programs available to entering students. Located in the old library building, University College sponsors a number of programs and services, including student tutoring, academic advising, IUPUI's honors program, a forum for general education and, most significantly, the learning communities program.

Established in the fall of 1995, the learning communities program is intended to help students learn to work and study collaboratively, develop essential skills of thought and evaluation, and familiarize themselves with the infrastructure necessary to navigate the university environment successfully. The program offers an introductory class geared to the needs of first-year students, as well as other classes that familiarize students with specific disciplines. Currently, learning communities courses are being offered in the schools of Business, Education, Engineering and Technology, Liberal Arts, Nursing, Physical Education, Public and Environmental Affairs, Science, and Social Work, and in the University College. Starting with just over 20 courses in the first semester, the program grew to close to 80 courses by the fall of 1998, with projections of well over 100 courses by fall 1999. Each learning communities course has an instruction team consisting of a teaching faculty member, a librarian, an advisor from the University College, and a student mentor.

According to Associate Dean Gayle Williams, 84 percent of incoming students admitted to IUPUI do not qualify to pursue courses in one of the disciplines represented by the degree-granting schools. The learning communities courses provide the only opportunity to link to the schools early in a student's academic career. In the 1997-98 academic year, there was a four percent increase in the retention rate of students participating in learning communities courses, compared with those students who did not participate.

The strength of the learning communities may be in their diversity. Expectations for the courses vary among the participating schools. The learning communities course "Windows in Science" serves as the freshman introductory course, according to Joe Kuckowski, learning communities advisor and professor in the School of Science. Piloted in 1996, "Windows in Science" is now required of all science majors. The course speaks to college life and adjustment issues as well as general skills development, it also introduces the student to the culture of science. Students are taught in this course to assess the credibility of sources by posing basic questions about the nature of science.

Kathryn Wilson, a professor of cell biology, stressed that the university is concerned with students' development of skills in critical thinking, communication, group work, sharing, decision making, and setting priorities. The new approaches being used in the learning communities program have influenced how she plans her course. She had been looking for ways to make her teaching more interactive and increase her students' engagement in the classroom. She added small group discussions and frequently started discussions of new topics by asking students what they already knew about the subject. This enabled her to adapt the material to the students' level and make the course more interesting. Wilson, over many years of teaching, had moved away from written assignments but has reincorporated them into the course, making them shorter. She stressed that her own satisfaction with her course has increased immeasurably since she introduced these changes.

THE PROJECT

The learning communities program originated outside the library, but its success is partly due to the innovative spirit and dedication that have characterized the IUPUI library in recent years. In the library's commitment to developing its own technical expertise, the introduction of team-based management, and creation of the Center for Teaching and Learning, one can see that it has brought a rich infrastructure of resources, expertise, and experience to this endeavor.

The Librarian's Role

Before the introduction of the learning communities courses, the library had a liaison system that was dependent on the librarian's effort and the needs expressed by the departments. Members of the instruction team characterized this effort as "hit or miss." Participation was limited to a small number of library staff. The learning communities program, however, requires involvement beyond the old reference department, an involvement many librarians seem to relish.

Librarians have been part of the instructional team for the learning communities program from its start, and their role now is to ensure that students understand the broader context of information. The librarians who serve on the instructional team reflect a range of library skills and experience, from cataloging and acquisitions to reference. Each learning communities course starts by defining its objectives and all members share the responsibility for ensuring that they are met. Instruction team members are encouraged to attend every class, since classroom observation and participation are so important.

Several years ago, University Librarian Philip Tompkins hired Jay Fern, a musicologist with a background in instructional technology and pedagogy, who had a joint appointment at the School of Music. Fern was brought on as a consultant to the library faculty, where

he provides expertise in pedagogy to the librarians who teach in the learning communities. He is their resource for instruction design and teaching improvements. He has supported the incorporation of technology into the communities because it made teaching more effective. The instructional teams needed this help to bridge initial gaps with librarians and to gain additional skills. The effort was organized around workshops—one-on-one sessions geared to facilitating an individual's integration into teams. According to Bill Orme, leader of the instructional team and the interim co-director of the Center for Teaching and Learning, this work helped to identify the skill sets. When participants were recruited into the instructional teams, they were mindful of the teaching experience needed for a particular subject or group of students. At the time, only three or four librarians were involved with the learning communities, yet the library administration was willing to pay for the expertise the group would need to be effective.

The librarians play an essential part in developing course content and devising examples for problem-solving and decision-making situations. Librarian team members also help form partnerships with other librarians. For example, the medical librarian and the university librarian have cooperated in support of the needs of the nursing program in the learning community. According to Joe Kuckowski, the librarians are the stable element in the instructional teams, since they are often involved in several courses having various faculty, advisors, and student mentors. Thus, it is often the librarian who is in the best position to identify how to solve problems that the team confronts.

Advisors and Student Mentors

Another key group in the learning communities program consists of professional advisors from University College. They help students with time management, suggest resources for other problems that students may encounter, and provide access to faculty. They also help the faculty develop course syllabuses and in some courses even serve as the instructors, as in the case of the X150 reading course, a refresher class in reading skills.

Student mentors are also an important component of the team. The mentors listen to the students as peers. They bring student perspectives to the instructional group and help close gaps related to age and culture. Student mentors recommend courses to their peers, help them find information, and serve as ombudsmen for the students. Discussions of how to attract more students to the mentoring program have considered increased pay in order to compete with the private sector in Indianapolis and on some form of certification that will be of long-term benefit to students. Another option is to let mentors earn academic credit. They receive four days of training per semester, one day of which is devoted to technology training. During the semester students keep a journal that provides them with a reflective learning opportunity.

Technical Expertise

The library technology group is indirectly involved in the learning communities because it ensures access to information resources. Comprising members of the library's client support, operations, and digital libraries teams, the group's primary aim is to ensure a standard software configuration for library workstations that is compatible with computer lab resources across campus.

Besides addressing hardware and software compatibility problems, the technology teams handle licensing issues and resource delivery needs beyond the physical boundaries of the library. They provide library-specific tools that are made available through interfaces such as OnCourse, a communications software similar to WebCT. They also do feasibility studies of new instructional technology components. They have shared their expertise with other colleges that want to make resources more available. Classrooms set up for training have been standardized with th learning labs to increase student familiarity with information technology.

Within the library, members of the technology teams have not been the only ones to offer technical assistance. Librarians have helped to negotiate, as well as deploy and support, a statewide partnership providing access to EBSCO products. The UITS staff believe this will help students become familiar with electronic resource interfaces, a foundation for working with other electronic resources when they arrive at IUPUI.

The close collaboration of librarians and teaching faculty has led to several new teaching approaches in learning communities. In a history course exploring Athens as the early model for modern day cities, the professor used a Web site that shows a 360-degree view of Athens from the Parthenon. This illustrated in a much livelier fashion many of the elements necessary for development of a city. In another case, a political science professor posted a dynamic syllabus allowing for changes in the legislative and judicial areas as they occur. For political elections, printed materials were inadequate, so the professor relied upon nonprint collections. Both of these courses increased students' understanding by going beyond the use of static images for teaching. At the same time, such courses push the library to think more strategically about collection development needs.

Library Team Structure

When Philip Tompkins became the university librarian, he introduced a new team-based organization into the library. He wanted to take advantage of the recent technological innovation and new library building to introduce a variety of new services and programs. Tompkins believes that, with the teams in place, the staff can accomplish a larger number of sophisticated tasks more flexibly and more easily. Cataloging, acquisitions, resource development, operations, and external relations are but a few of the teams that were established. Tompkins has relied on a strong group of middle managers to

evolve into team leaders. All library faculty are assigned to at least two different teams.

Team involvement in the library has given librarians experience with the team process and skills for collaboration. When the library administration started with the teams, the emphasis was on organizational process. Establishing trust within teams was important. Tompkins spent his first three or four months interviewing library staff. Shortly thereafter he established the team structure and assignments. According to Deputy University Librarian Lewis, "We spent a lot of time talking about what a team is and how it is different from a committee."

One way in which commitment to the team structure is reinforced is by giving people the time and training they need to maintain and develop the teams. The library administration supports three weeks per year of organizational development, during which workshops address organizational process, leadership, staff development, and planning. During these periods, full- or almost-full-time employees, librarians, professionals, and staff are required to attend the workshops and are able to devote their full attention to strategic and developmental issues. Under the direction of an outside consultant, the library staff has been using the Birkman Assessment Tool to understand individual working styles. When the workshops end, the consultant continues to provide feedback to the team leaders as needed. Two library staff members have also been trained in the Birkman assessment method. Through the use of the Birkman assessment, staff have gained knowledge of how to work together, allowing them to keep personality differences from interfering with work.

Overall, the library staff seem to view the team structure as a key element in achieving far better horizontal communication within the organization.

Faculty Development: Center for Teaching and Learning

The Center for Teaching and Learning gives faculty members the support they need to become more effective teachers. Led by Associate Dean Erwin Boschmann, the center is a cooperation between the Office of Faculty Development, librarians, and the University Information Technology Services. It is housed in the library and high-level library staff hold key administrative positions. The center has two major programs. First, it offers one-on-one consultations for faculty members to assess their teaching. This observation is followed up with appropriate research information to supplement the teaching assessment.

Staff from the Center for Teaching and Learning also provide varied technological expertise for enhancing teaching through the use of multimedia. Faculty members come into the offices in the library to use computer and multimedia equipment reserved for their use. The assistance is also consultative and increasingly includes in-

formation about teaching aids. The approach has been to look at needs from the perspective of student learning.

Ann Kratz, the center's assistant co-director, said that the center provides faculty the opportunity to succeed, or to fail at no cost. They can try out new approaches using new technology or teaching techniques, or both, in an effort to change or enhance their teaching. The center encourages the faculty to help each other and also provides an opportunity for center staff to promote and inform the faculty about the learning communities. Since the other assistant co-director of the center, Bill Orme, also leads the library's instructional teams, the center staff is able to provide guidance on setting up a learning communities course. The center also serves as a clearinghouse for copies of successful grant applications, tenure and promotion packets, and other documentation for faculty use.

The center also has helped introduce new technological platforms. It has promoted the OnCourse template, which offers faculty members bulletin board, chat room, e-mail, syllabus, and electronic reserves services, as well as access to administrative databases such as registration. More than 400 courses, enrolling some 9,000 students, currently use some form of the OnCourse template, which was developed in 1997. The staff that leads the center is well-versed in the current research literature on teaching, demonstrating that doing something is the best way to learn it. They view technology as a means of delivery (television, video) and as a means of engagement that requires the student to interact at frequent intervals, thus ensuring better learning. Each course using the OnCourse template has a section of tools that are helpful for the specific course. This method of learning encourages moving from concrete to abstract thinking. It also fits the student's penchant for convenience, providing the opportunity to use it for teaching. The course template has strong central administration support within the university and promotes an interactive pedagogy.

RESULTS

One measure of the success of the learning communities is the size of the operation and the steadily increasing number of courses each semester. No one seemed to view increased demand as an insurmountable problem or as more work simply piled on existing duties. (It is hard to imagine many situations where library staff would face an increase of 40-50 sections of bibliographic instruction in a single year.)

The IUPUI library's involvement with the learning communities is a remarkable endeavor. Librarians have teamed with faculty as full partners to develop and teach courses that are deemed crucial to the strategic interests of the university. The effort is at the cutting edge of contemporary thinking about technology and pedagogy in higher education. Further, this activity is taking place on a scale rarely seen at comparable institutions.

Conditions of Success

This success has been possible because of a confluence of developments. First, the library has had farsighted leadership. The commitment to technology and a new building were unusual. Under Philip Tompkins, these advantages have been fully exploited. The building provided the opportunity to include elements, such as the Center for Teaching and Learning, that have allowed the library to support many projects. Tompkins has also identified himself closely with institutional priorities. His interest in learning styles theory and its application in libraries fits well with the strategic vision for the University College. Tompkins also saw that the commitment to technology needed to reach across the whole library. He has implemented team-based management, and the associated professional training activities have made technological change less threatening to library staff. Consequently, trust has developed in all quarters.

Second, the corporate culture of the IUPUI library is one not found in many other libraries. There is a belief that the investment in professional development is tied to the success of the enterprise, as evidenced in the commitment to the three annual one-week planning and staff development meetings. This link between the library's culture and its impact on personal development may best be illustrated when things go wrong. At the IUPUI library, failure does not carry a negative penalty. One can learn from it. Deputy University Librarian David Lewis recounted an early experience with the library's interface. Earlier versions of the Web browser Mosaic often crashed. Reference librarians learned not to blame the technicians but to try to resolve the problem with a system reboot, an attitude that continues to characterize their work with new software and hardware.

Third, there is adequate funding for most projects and activities. In these times, it is rare to find a university that would put a team of four trained instructors in a classroom for beginning students. The learning communities program, with its courses led by a faculty member, a librarian, a professional advisor and a student mentor, is an example of financial commitment. Another example is the willingness to hire a musicologist-instructional technologist as a consultant to the library faculty.

Next Steps

The library administration and the instructional team leader have focused on how to continue increasing the operation to meet the extraordinary demand for classes. Gayle Williams, University College assistant dean, indicated there is a campus-wide committee looking at the first-year study proposal. Committee members will provide oversight and assessment of the program, as well as suggesting less costly alternatives. Many of the participants acknowledged concerns related to scaling-up of this program and to questions from deans about program coverage.

The future of the learning communities is, therefore, still being defined. There have been discussions of reducing the delivery time

frame of the basic skills to a period of 8 weeks instead of 15, to intensify the focus and to help address the disparity of skills among students. More work is needed to understand the relationship of the program's structure to its impact. There must also be better understanding of which skills are important for the students' success and of new ways to make effective practices more widely available. The library administration also plans to increase staffing to support the learning communities.

Lafayette College

An Interdisciplinary Team Approach

http://www.library.lafayette.edu/

BACKGROUND

Lafayette College is an independent, selective liberal arts college, founded in 1826 and set on a beautiful 110-acre campus in Easton, Pennsylvania. About 2,200 undergraduates and 200 faculty members work together in what the college calls "a small college environment with large college resources." Nearly all Lafayette students reside on campus, which helps create what President Arthur J. Rothkopf describes as "a close-knit community of learners and doers."[1]

Teaching and student mentoring are the top priorities of the faculty. Consequently, Lafayette College's faculty and administrators eagerly embraced the concept of using technology as a way to promote more active and individualized student learning. The staff of the library agreed, but wanted to translate the concept into a tangible project. The librarians recognized—by virtue of their position as developers and users of information technology and as regular teaching partners with the faculty—that they were in an excellent position to take the lead in providing a link between technology and the classroom.

THE PROJECT

The library formed an Educational Technology Support Team in 1996, made up of three librarians, a colleague from Computing Services, and an instructional technologist. Neil McElroy, the director of the library, encouraged formation of the team because he believed the library needed to do something more to help the Lafayette community exploit the Web. The team's initial work focused on support for campus applications of the World Wide Web, through workshops on topics such as writing Web pages, biweekly noontime presenta-

1 "President's Message: Celebrating Opportunity," *Lafayette Magazine*, Spring 1998, p. 2.

tions in which faculty members shared their experiences with the Web, and individualized support. Team members helped the faculty create class Web pages and experiment with applications of educational technology.

In its second year, the Educational Technology Support Team expanded its efforts by launching a mini-grant program, funded by the provost and administered by the team. From the funds provided, the library awarded grants of $1,000 to faculty members who proposed projects for using technology to improve teaching and learning. These grants provided compensation for the time needed to implement the project. The team awarded five mini-grants the first semester and four the second; one team member was assigned to work with faculty members on each of the grant projects.

In the third year of the team's operation the college installed eleven new electronic classrooms and reconfigured a twelfth. Team members are providing support for the 70 faculty members who teach in these rooms. For example, the instructional technologist maintains a faculty e-mail list to facilitate exchanges about electronic classroom issues and developments.

The expenses of the projects have been covered in large part by the provost's support of the mini-grant program and by the college's commitment to infrastructure improvements and classroom upgrades. The library also provided some support from its operations budget, but the main library expenditures have been in time rather than dollars, and the librarian did not see financial limitations as a significant barrier to maintaining the team approach.

Library staff made a large contribution to the evolution of the educational experience at the college. The decision to form an educational support team to provide the Lafayette community with "close support and quick response" as it implements new educational technologies has been a pivotal one. The team has provided basic instruction and support; has created a forum in which the faculty share ideas about teaching and technology; helped advance the provost's educational goals, and, in the process, enhanced the reputation of the library and its staff. One faculty member, summing up a widely held view of the library, said: "If you've got an idea, they'll find a way to help you with it."

The college recognized the contributions and impact of the Educational Technology Support Team by presenting team members with the annual campus teaching award. The surprised and gratified winners used their prize money to buy a digital camera to enhance their work.

RESULTS

With the formation of the Educational Technology Support Team, the initiation of the mini-grant program, and the expansion of electronic classroom facilities, the provost's goal of increasing the proportion of faculty members who use technology in teaching is being realized. One interviewee estimated that perhaps half of the Lafayette faculty

is now using some kind of technology in the classroom. The library staff's increased involvement with campus pedagogy has created teamwork at the working level. For example, first-year seminar bibliography sessions have led to substantive conversations with faculty members about Web resources. Faculty who have participated in the mini-grant program are using new technologies in several disciplines, as the following examples illustrate.

- After attending a team-sponsored brown bag luncheon about the value of positive reinforcement in teaching basic principles, one physics professor created a software package to provide instant feedback to students on the quality of their homework assignments. The program allowed students several attempts to get the right answer, a degree of support that he himself could not have found time to provide. He noted that most students have doggedly done and re-done problems to get them right, even if they account for only a small part of the grade. Succeeding in the homework problems gives students a sense of accomplishment and confidence while also building their mastery of the course basics.

- A psychology professor wanted to use technology to encourage more interaction among his students and to provide a richer array of resources. He created a comprehensive Web site for a class of 40 students and he has seen improvement in the breadth of information and the number of sources that students use in their papers. The students' presentation strategies are also now more diverse. He has found that his online bulletin board offers a good learning alternative for students who do not participate much in class discussions. He anticipates eventually changing the way students submit their assignments and papers.

- A professor of languages is working with the special collections librarian to design a multimedia program to access special collections through the Web, particularly the wealth of material in the college's Lafayette collection. She is enthusiastic about the new dimensions that special collections bring to her teaching of current courses and her development of new ones. ("Political Institutions of France," a survey of French literature, and a French civilization class are among those that will use this material.) The grant was a spur to defining the idea and developing a plan.

- The videoconferencing facilities at Lafayette have allowed engineering students studying abroad to participate in core courses being taught on the Easton campus. This allows them to continue making progress on their degrees while studying abroad. These same conferencing capabilities enable joint language instruction on the Lafayette and Lehigh campuses, allowing both institutions to offer language courses that would not have had sufficient enrollment on a single campus.

Challenges: Staffing and Classroom Support Issues

The roles and responsibilities of the librarians have changed considerably because of the innovative work of the Educational Technology Support Team. The library has handled this team work so far with no new additions to its staff of 25. The library director recognized, however, that a specific assignment within the library for information technology was not a short-term need. Thus, the position of instructional technologist, which had been part-time and supported by grant funds, was expanded to full-time, with full college funding. Despite the new demands on library staff, faculty members do not perceive a decline in traditional library services. However, library staff members admit that they have had to defer other projects, such as enhancing the library's own Web site.

There has been discussion of adding more instructional technology staff and creating an educational technology support unit in the library. If this were to happen, the role of the Educational Technology Support Team would be reconsidered. Team members are not troubled by the prospect of a diminished role, as long as librarians stay involved in educational technology and there is some centralized support for faculty who want the assistance "all in one spot with people you get to know." For Lafayette College, the library has become that spot.

Faculty members have raised some concerns related to the new emphasis on technology. Several worry about the lack of technological expertise on campus. Faculty members have had to be fairly self-reliant in setting up class Web pages and doing their own scanning and other computer-related tasks. One faculty member hoped he would not always have to be a Webmaster himself. Another professor raised concerns about how the college-wide emphasis on educational technologies would affect evaluations for tenure. Recognition for technology use as it relates to scholarship, teaching, and service needs to be more clearly defined. Finally, while faculty members have found it productive to work with students in developing new applications of technology, student initiatives and student-authored projects are often difficult to maintain when a student leaves.

As classrooms are automated and updated, new problems arise with their use. According to one student whose history class happened to be in a new classroom, it took the professor "forever" to figure it out. Problems that can hamper productive use of classrooms are not necessarily complex technical issues. Problems such as control of window shades are trivial but frustrating. There is not yet a designated staff member to assist faculty who find that a bulb is out or that the projector does not work. The instructional technologist assists if she is available; many faculty members, however, would like a "911 response" when the success or failure of a lesson plan increasingly depends on the smooth operation of classroom equipment, including more traditional audiovisual equipment.

Conditions for Success

In the campus visit, staff and faculty members were asked what factors had contributed to their successful applications of educational technology. The following were given as reasons for success.

- Library staff viewed the launching of the support team as manageable in part because they initially committed to trying it only for a year. Setting a time limit gave them courage to go ahead.
- The team structure allowed for different areas of expertise to be represented and presumed a sharing of the work.
- Including a member of the Computing Services staff on the team helped the library to maintain good working relationships with that department. The Computing Services staff has been glad to have the library take the lead in this type of faculty support, enabling computing staff to focus on network maintenance, faculty hardware support, and training in the use of e-mail, word processing, and other common campus software.
- Keeping the team relatively small facilitated decision making and implementation of ideas. While it might have been helpful to have a faculty team member or a faculty advisory group, it would have added more structure and layers to the team and might have slowed it down.
- The support team is seen as a grass roots project, not a top-down administrative mandate. Library staff had written some of the first Web pages on campus, and they knew what it was like to need help. They wanted to help their faculty colleagues.
- The library director planted the seed and then let the staff develop the idea. In one librarian's view this permissive leadership allowed staff to find out what they needed to do. Librarians have continuing support from the library director and are given the time and freedom to be flexible and to undertake "what comes in the door."
- Library staff have drawn definite limits in deciding what services the team provides. For example, they have refused to be troubleshooters and do not provide on-call support for the electronic classrooms. The team also did not take on the task of maintaining Web pages for individual classes. Faculty members have often hired students to provide this assistance.
- The provost contributed a great deal of initiative and momentum in her support of the mini-grants and for the "year of the classroom" project. She has been eager to see faculty members make creative use of educational technology, and having it available in the classroom makes it easier for faculty members to try it.
- The campus community displays a collegial attitude toward librarians. Library staff believe that the provost trusts them and that faculty members think of them as valuable colleagues with expertise to share.
- The president has been supportive. By making the library one of three topics of focus in the Middle States Accreditation review, he set the stage for reinforcing the work of the library and supporting

its requests for more resources and more space. He has recognized that the library is a place of continuing value in the digital age.

- The library newsletter has helped publicize technology initiatives and accomplishments across the campus and with other colleges and universities.
- A key to the success of the project has been its personalized, individual approach, or what the library director characterizes as close support.

Point Park College and the Carnegie Library of Pittsburgh, The Library Center

A Public-Private Library Partnership

http://www.clpgh.org/clp/libctr/

BACKGROUND

The Library Center, which combines the Point Park College Library, the former Business Library, and the Downtown Branch of the Carnegie Library of Pittsburgh, is a unique partnership between Point Park College, a four-year private professional college located in downtown Pittsburgh, and the Carnegie Library of Pittsburgh, a major urban public library. The college was founded in 1960 as a two-year community college. It has four downtown buildings and the Pittsburgh Playhouse in nearby Oakland, which is used for classes and programs of the Department of Fine, Applied and Performing Arts.[1] The downtown buildings include Academic Hall, with classrooms, laboratories, a newsroom, a television studio, a computer center, and administrative offices; Lawrence Hall, a 21-story building with dance studios, classrooms, and student service facilities; and Thayer Hall, which houses the Point Park Children's School and additional dormitory rooms.

The Point Park College curriculum includes computer science, education and teacher education, engineering, health sciences, social science, performing arts, and business and marketing. Because the college emphasizes the fine, applied, and performing arts, it requires an auditorium and sophisticated video equipment for teaching and assignments. Its reference requirements are for traditional and electronic indexes, along with other standard reference materials. The collection is developed in response to the academic needs of the college.

The Carnegie Library of Pittsburgh's expectations for the new library were that it would give the downtown community open access to all collections and that it would support the business commu-

[1] At press time, the department had been renamed the Conservatory for Performing Arts.

nity in particular. The library also serves as a convenient service site for several community-based organizations that are closely affiliated with the public library, including the Literacy Council and the Small Business Administration. The library's Job and Career Center, Foundation Center, and Family Center serve special user needs.

The college and the public library serve different users who, by and large, need different materials and services. There is little overlap in subject and collection requirements. There is mutual interest in the fields of business, journalism, and communication, but most of the other fields are particular to one library or the other.

The public benefits from the large, although necessarily unbalanced, academic collection, and the college benefits from the large business reference collection of the public library. Now there is the opportunity to build a broader reference collection that serves both constituencies through acquisition of shared electronic databases and services.

THE PROJECT

This partnership is a story of need finding opportunity through collaboration of committed, pragmatic professionals. In the early 1990s, Point Park College President Matthew Simon and Carnegie Library Director Robert Croneberger faced similar problems that could be met by a common, if unusual, solution. President Simon envisioned an improved and expanded library for Point Park's 2,300 students and 195 faculty members; Director Croneberger needed a permanent home for the Downtown and Business Information Center Library, which had been housed in numerous rented locations since the 1920s.

Although they may both have had a need for space and a lack of funding, the missions of the two institutions and their funding and governance structure were entirely different. The privately funded college needed a library to support its academic program, whereas the Carnegie Library needed a new site for its downtown branch, which traditionally focused on business patrons. A possible solution to the problems of both institutions appeared when a historic building that had previously served as a banking center and retail mall was offered as a donation to Point Park College.

The two presidents agreed with a handshake to work together to create a library that served the patrons of their two respective institutions. What the staff refer to as a gentlemen's agreement was in fact a wedding of opportunity and need, through which the two disparate institutions have been able to forge a partnership. At the time of the agreement, there was no other library in the country that was shared by a private college and a public library system. As of this writing (December 1998), there is still no other, although negotiations between San Jose State University and the City of San Jose for a similar venture have been under way for some time.

The Point Park College Academic Library and the Carnegie Library of Pittsburgh now share a restored turn-of-the-century build-

ing called The Library Center. The entrance building of this 60,000 square-foot structure, built in the classical revival style about 1900, was designed as a bank by Frederick Osterling, an eminent local architect. In 1974, the buildings were remodeled as an indoor retail mall known as The Bank Center. But the mall failed to attract sufficient business, the owners filed for bankruptcy in 1981, and the building closed in January 1987. The Bank Center building was officially donated to Point Park College in June 1990, and shortly thereafter, planning began to create a combined academic and public library.

The Library Center opened to the faculty and students of the College and the public on May 12, 1997. In an article on "The Library Center" published in the *Carnegie Magazine* (March/April 1997,) Abby Mendelson wrote, "Blending Carnegie Library's 30,000 volumes, plus serials, bound periodicals, and microfilm/microfiche archives, with Point Park's 124,000-volume Helen-Jean Moore Library has created an information juggernaut—but now with the world literally at your fingertips via the Internet, the depth of the well is literally without measure." Use of the library (about 800 people or more per weekday) is growing, and is predicted to increase considerably in the years ahead.

The Library Center contains more than 150,000 volumes, 10,000 reference works, subscriptions to 612 periodicals and newspapers, and multimedia materials. Its patrons have access to the World Wide Web. The Business Center on the second floor provides business information in all formats, including online and CD-ROM disks; the International Business Collection supports Point Park College's master's program in international business. A joint general reference department serves both academic and public library needs. The reserve room and the college's electronic classroom are maintained for the exclusive use of students and faculty. The classroom is the only area of the building not managed by the Carnegie Library.

The Library Center is a participant in the Electronic Information Network (EIN), the countywide library network that provides public libraries with an online catalog, circulation systems, and access to commercial databases (such as Info Trac, EBSCO*host*, GaleNet, Britannica Online, and Grolier Online), as well as the Internet. The Library's catalog includes the holdings of public libraries in Allegheny County.

The Library Center is administered by Director Pam Maxwell Craychee. Its funds are provided by both Point Park and the Carnegie Library. The conversion from bank building to library and the initial start-up costs were supported primarily by a foundation grant and by fund-raising efforts. The college owns the building, and the Carnegie Library manages and operates the library under a formal agreement signed by the former president of the college and the former director of the public library system. (The agreement is now being reviewed by the present administrators of each organization.) The core planning committee for the building's renovation included administrative representatives of both organizations.

The Process

Despite the good faith and commitment to collaboration of both leaders, Point Park College and the Carnegie Library of Pittsburgh took considerable risks in planning one library for use by both a private college and a public library. The planning phase of The Library Center lasted approximately seven years (1990-1997), drawn out by architectural challenges, increasing costs, changes in leadership, and unanticipated delays. The departure of President Simon in the middle of the planning phase and the untimely death of Carnegie Library Director Bob Croneberger seven months after the opening, left the project without the guidance of the administrators who had conceived the idea. During the planning phase, faces changed many times. The college had two interim presidents after Simon returned to teaching, and Point Park's trustees took a more active role in the planning process and leadership of the college. The original project director resigned, and the library director chose to leave the library for a teaching position in the college. Carnegie Library delegated its planning activities to the deputy director, and seven months before The Library Center opened, appointed an assistant director as its interim director to complete the project.

The decision to create a combined library was made at the highest levels of both institutions, but the implementation of the plan was originally entrusted to the libraries' staff members. Those who were responsible for making it work had few, if any, precedents and little guidance in the literature they consulted. Staff from the two libraries were appointed to task forces. They read books on problem solving and teamwork, hoping to find suggestions that would help them work productively together. They shared their concerns and jointly analyzed the problems and issues, assigning leadership responsibilities on the basis of staff skills and institutional interests. They remember the early days of the project as a difficult time when staff felt apprehensive about the magnitude of the task ahead.

At first, staff efforts at team building were frustrated by the tendency to focus on the differences among staff, mission, and patrons. One staff member reported that once the top-level decision had been made and the responsibility for implementation moved down, the staffs of both libraries lacked any consistent guidance from above or any reassurance that their work was on the right track. These early difficulties and the misgivings that accompanied them abated with time, however, and there is little lingering evidence of that difficult transitional period.

An unanticipated benefit of the drawn-out planning phase was the opportunity to take advantage of technological innovations. Recognizing that the new library would have to offer access to online databases, CD-ROM databases, e-mail, and the Internet, the planning group ordered 100 computer terminals that were versatile enough to serve as word processors for staff and as gateways to remote databases for all. The wiring demands that this made on the old building created serious challenges for the renovation team. Technical expertise for the electronic network of the library was available from EIN.

Economies of scale were realized by having the Carnegie Library take responsibility for integrating and updating the cataloging for all of the acquisitions of the two former libraries. The college, for its part, provided expertise for the integration of The Library Center into the college communications and instructional systems.

Funding

In the 1990s, neither the college nor the library were fully funded for their primary mission work, let alone for taking on a new initiative. Finding sufficient funds for the renovation was a major problem, and, as time went on, funding needs increased as costs rose. The Buhl Foundation provided strong early support to the college, and the college took the lead in raising funds for the building renovation. It was necessary for Point Park College and the Carnegie Library to join forces in soliciting additional funding for the project and operating costs. That joint fundraising effort, including appeals to the public, remains critical to the success of this project. Fortunately, there has been considerable public support for The Library Center, because of the public library's strong commitment to the Pittsburgh community and the leadership of the college and its trustees.

The college now covers the expenses of maintaining the building and security services, while the Public Library supports the staff and all library services, including technical services. The college and the library operate on different fiscal years and their budget planning is fundamentally different. This lack of synchrony makes it all the more important, then, that the two institutions revisit their operating agreement periodically to adjust to any changes in funding. Frequent communication between the executive officers of the college and the library is essential to the continuing success of The Library Center.

Renovations

The renovation and preservation of a historically important building was not easy: lighting, heating, and air conditioning had to be upgraded; asbestos had to be removed; and every one of the building's 22 distinct levels had to be made wheelchair accessible. The renovation of the building was undertaken by Syl Damianos, an architect known to be sensitive to the original architect's vision. He had worked on several other building projects for the public library system and so was familiar with the needs of library buildings. Throughout the renovation, the architect had to fit new functions into spaces designed for other purposes (for example, one original bank vault was converted for newspaper storage, another to a small computer lab). Network wiring had to be added to a building that had been designed long before the availability of computers and networks, and this involved trade-offs that pleased no one. For example, as costs for wiring crept up, the number of reference desks decreased.

The reporting system of the renovation team exemplifies the ways in which the two institutions constantly had to find ways to collaborate across institutional lines: the architect reported to the college, yet the renovation plans had to be made within the context of the work performed by both the Point Park College and Carnegie Library staffs. There were trade-offs between maintaining architectural integrity and making the library more functional, and library staff members have had to modify the space further to fit their needs since they occupied the building two years ago.

The Opening

With the reassignment of the college library's former director as a professor in the college, the college had the expertise it needed to enhance its required course in information literacy. The former director was also given responsibility for a Faculty Resource Center to support faculty members in their use of technology. The college sought funds for workshops and equipment to facilitate this work. When The Library Center opened, the staff had received little training in the use of the new network, although they were expected to use it and to train others. They reported that the new library opened before they were really ready for it to open, and they soon found themselves establishing a first-year goal of simply trying to "stay afloat." As President Henderson remarked, the foundations supporting The Library Center, as well as the students, were impatient to see the results of the renovation. The pressure to open on schedule after years of delay, even if all was not ready, was overwhelming.

RESULTS

The Library Center's first two years of operation, although a period of constant adjustment for the staff and users, have brought considerable achievement. A sense of accomplishment and optimism for the future are now palpable. The Library Center and its organizations, the public library system and the college, have devoted time to identifying the issues that need further resolution. Some of those issues have cost implications and some do not, and they have been incorporated into the organizations' respective strategic plans.

As President Henderson said, the now-formalized operating agreement that began with a handshake is viewed by both partners as a living document. It represents a relationship built on trust and aimed at maximizing mutual benefits. The library is critical for the college, which is planning to increase its course offerings and student body, and is investigating becoming a university. During a recent accreditation visit to the college, the Engineering and Technology Accreditation Board commended the library in particular for its services to students and faculty. The Library Center is equally important for the public library, which needs a vibrant downtown branch to serve the people of Pittsburgh, and its business community in particular.

Because the new building has proved a congenial place for people to visit, use of the building, its collections, and its services has grown. Everyone recognizes that The Library Center is inadequately staffed for its rapidly increasing workload. Expanding the training for staff, faculty, and students, including training the faculty to use electronic resources in their courses, is also critical to the success of The Library Center, and this is reflected in the college's strategic plan. The head of Academic Services tracks technological developments in high schools to gain insight into what students may know and expect when they arrive at Point Park as freshmen. Only part of the campus is wired for the Internet. Ensuring that this critical part of the college's infrastructure extends beyond the library is a high priority.

Challenges

One of The Library Center's biggest challenges is less tractable than the staffing and training issues. The strictures of working in a beautiful building meant to hold money and bankers, not books, computers, and researchers, is something that staff and patrons struggle with every day. Use of college facilities after hours, such as the multimedia theater, presents security problems, in large part because the building was not constructed for such use. In typical early twentieth-century style, all rooms debouch onto a common area, the "grand atrium," and the main entrance serves all the interior spaces. The building has little flexibility, and it is hard to close one part and leave another open.

The spatial arrangements within the old building make it difficult to segregate the different types of users. This explains the decision to have student services on each floor and special reading rooms and collections for students on the third floor. As in all public libraries, there are disruptive patrons, those who come to use the Internet for non-serious purposes, and those who come in simply because it is a public space.

The mingling of spaces and collections also presents challenges for reference librarians. The business collections are patronized by the public, who come looking for answers to questions, but also by students, whose teachers expect that the reference staff will guide them in finding the answers themselves. Reference staff sometimes have difficulty making the switch from one type of service to the other.

Finally, the shared governance of the building presents some logistical problems. Nonetheless, The Library Center, housed as it is in a landmark building, has given this urban college a beautiful core for its vertical campus.

There are few problems that cannot be ameliorated or even eliminated by communication between the college and library staffs at all levels. The library director is invited to attend faculty meetings, and there is talk of building closer peer relations with the library. The head of Academic Services at the library is a tenured member of the college faculty. The president of the college works closely with li-

brary management and served on the search committee for the successor to the late director, Robert Croneberger.[2] The chief executive officers of the college and library review the five-year operating agreement regularly to anticipate any modifications that might be needed. Both college and library managers realize that their continued successful collaboration will demand constant attention and commitment.

[2] Herbert Elish was appointed director of the Carnegie Library of Pittsburgh, effective January 1999.

Southern Utah University, Gerald R. Sherratt Library

One Librarian Introduces EAD Finding Aids

http://www.li.suu.edu

BACKGROUND

Southern Utah University (SUU), although founded 102 years ago, has been a comprehensive university for just five years. This publicly funded university enrolls nearly 6,000 students and has a full-time faculty of 200 and another 77 faculty members with adjunct appointments. The total budget for 1998-99 is projected to be $64.3 million. The university prides itself on offering a personalized approach to higher education. Students are promised small classes with individual attention from the faculty and a rural, contemplative environment—a place to think and learn away from the rat race of modern, urban society.

The new Gerald R. Sherratt Library, not yet three years old, is an inviting, pleasant building that has been designed with the needs of students firmly in mind. The library's annual budget in 1997 was $1,238,769. The collection contains approximately 209,000 book titles, 2,333 serial titles, and 615,223 microforms. The library staff is made up of 7.37 full-time equivalent (FTE) faculty, 7.83 professional staff, 4.87 classified staff, and 7.51 students. The faculty members have both library and teaching responsibilities and are subject to the same terms and conditions as other faculty on campus. They have nine-month appointments and most hold either a Ph.D. or double master's degrees.

The state of Utah is convinced that technology is an equalizing force in higher education, and has invested significant resources in the publicly funded libraries, both to enhance access to electronic resources and to provide grants for pilot projects in which librarians can learn more about the applications of technology.

THE PROJECT

While many of the innovations described in other case studies involve campus-wide or library-wide initiatives, this case study focuses on a project that was conceived and undertaken by a single librarian who saw an opportunity to make a difference. Special Collections Librarian Matthew Nickerson was faced with a daunting task when he assumed responsibility for the division in 1997. Although more than 200 collections—some very large, some quite small—had been acquired by or donated to the library over its 100-year history, only one collection had been processed and had a printed finding aid. The manuscript materials had been moved from the old library building, but remained in boxes. After the long-time head of Special Collections retired, no one was certain of the contents or whereabouts of many of the individual collections.

The Search for a Solution

Nickerson, whose previous experience had been in collection development, turned first to his special collections colleagues at the University of Utah and Brigham Young University to learn more about how they described and organized similar materials. He visited the two campuses to observe operations and seek advice. Both these institutions were creating printed registers for their collections and both were experimenting with digital access. Both universities were also creating online registers, independent from their printed registers, which involved a lot of duplicated effort.

Nickerson recognized that SUU wanted a process that could use one data entry for creating both printed and online versions. In a sense, he was inspired by what the other two schools were not doing. A colleague at the University of Utah mentioned SGML (Standard Generalized Markup Language) in passing, and through his subsequent research Nickerson discovered EAD (Encoded Archival Description). With this discovery, he realized he could leapfrog into a good position by employing EAD from the beginning.

But realizing that the solution to his organizational dilemma lay in EAD, and employing it, were two different things. He had not worked in special collections before, and he knew very little about recent trends and developments in that area. He turned to the World Wide Web and listserv discussion groups to educate himself. He studied the work on EAD at the University of California at Berkeley, and then had discussions with librarians at Duke University and the University of Texas at Austin. He downloaded the Library of Congress's EAD DTD (document type definition) information and taught himself to apply it to manuscript materials.

Still, he realized that the work going on in these large research institutions did not provide an entirely usable model for Southern Utah University. Nickerson identified four requirements for any system for organizing special collections materials:

- It can generate both print and electronic finding aids.
- It can produce HTML (Hypertext Markup Language) "on the fly."
- It does not require a browser plug-in.

- It is inexpensive to implement.

Designing and Refining the System

Understanding the essential requirements was a vital first step. The second was equally important: the library's network specialist, LaMonte Charlton, was asked to help find off-the-shelf, easy-to-use, and inexpensive methods of meeting the requirements. Charlton and Nickerson combed through Web resources and talked to colleagues in other libraries about their experiences with EAD. They concluded that an old '486 computer could be made into a server. Linux was installed on the server. The technical team decided Word Perfect's SGML editor was adequate to handle the project.

The first system served as proof of concept, but Nickerson recognized that the system was too slow to be made available to staff and users on the Web. He discovered a state LSTA mini-grant that did not require matching funds. In collaboration with the faculty development grant specialist, Nickerson developed a proposal for $7,500, the maximum allowed in the mini-grant category. He was awarded the grant, and $5,000 of the funds was used to purchase a new server and a CD-based copy of Linux. The remainder was used to pay Charlton to modify I-Search software by writing C++ code and perl scripts.

To learn more about the national standard, Nickerson attended an EAD training session sponsored by the Society of American Archivists at New York University. There he met Daniel Pitti and Kris Kreisling, developers of the EAD standards, and he was later able to send questions to them via e-mail that arose during the SUU project.

Using the SGML editor that is standard in WordPerfect 8.0 software, Nickerson created templates that simplified data entry for the students hired for the project. With the templates, the first half of every finding aid was automatically generated. For the second half, requiring individualized data, WordPerfect macros were created for all the principal EAD tags.

Three students have been employed to enter data for special collections materials, and thus far, 30 collections have been processed using the beta version of EAD. Now that the 1.0 version is available, the current focus is on converting the beta test data into the 1.0 version and then continuing with the 1.0 version for the 200 remaining collections. Links were created between the existing OPAC and the EAD by creating a MARC record for each collection and using the 856 field to link it to a Web page that searches the EAD finding aid. This added level of access is a significant and unique part of the system.

Traditionally, the library has provided access to collections beyond SUU's holdings through Interlibrary Loan. More recently, the library has begun to offer its users access to a wide range of electronic databases. Nickerson's EAD project is in keeping with these efforts to provide better information access to students and faculty. But

there is another benefit attached to his project: access to SUU's unique collections is being offered to users outside the campus.

Management Support

The Sherratt Library faculty had not identified the EAD project as a priority, but there has been support for Nickerson's initiative. Dean of Libraries Diana Graff also serves as associate provost, and her primary focus the last few years has been planning and overseeing the move into the new library building. In addition, a new provost, Ray Reutzel, took office in September 1998. He described campus management of information as the institution's most pressing need. He also emphasized the need to provide better access to technology and said that the library has been very effective in providing assistance to faculty in the effective use of technology. He believes, however, that there must be a greater campus-wide effort to incorporate technology into teaching. He is encouraging all members of the campus community to move toward Internet-based models that are inexpensive to maintain.

Dean Graff acknowledged that the EAD project could not have been accomplished if the library had relied on the computing center for help. The computing center provides service to the entire campus, and the library has no priority. She participated in the development of the university's five-year technology plan, written in 1995, but even in that university-wide document, the library is assigned responsibility for its own technology needs. The library decided a few years ago that it must chart its own technological future.

The library faculty chose to use the library's furnishings budget to install fiber-optic cable to every desktop in the library, rather than purchase new furniture. They saw the new library building as an extraordinary opportunity to make an investment in technology that the university as a whole was not yet prepared to make. The university is not well-funded for networking, and thus far, the fiber-optic system has been connected to buildings on campus but it has not been extended to faculty workstations. Departments must find the resources to make these final connections.

In addition to installing fiber-optic cable in the new library, the university participated in a collective arrangement, the Utah Academic Library Consortium, to provide access to a variety of electronic databases for all of the campuses. The library has found that participation in such cooperative initiatives yields more services for its users than if they were purchased individually.

RESULTS

Matthew Nickerson's interest in linking special collections to the library's online catalog led to the identification of a new electronic means for indexing and organizing such materials for a broader community. The librarians hope that this project, which resulted in a special method of providing subject metadata at the front of the digi-

tal collection, will allow these terms to be picked up by the many browsers who mine the contents of the Web.

Library and university administrators admire how much was accomplished at so low a cost, and the librarians are proud of the significant new service they have been able to offer. Although only 3 of the 30 collections processed thus far contain images, the library is confident that all 200 collections, including many visual images, will soon be available to users.

The faculty and an independent researcher who were interviewed praised the simplicity of the project and its ability to make SUU's resources better known. Those interviewed were surprised to learn that the holdings are more extensive than they had realized. They share an interest in local history and are quite familiar with the actual manuscript collections. All are enthusiastic about the EAD project, for they believe the collections will be of great value to researchers elsewhere who are interested in the history of southern Utah. They foresee opportunities to work more closely with federal land management and archeology projects under way in southern Utah because of the library's ability to make historical images of the region available. They are also hoping that the SUU digital collections will be joined by other institutions' digital collections relating to southern Utah, resulting in an extensive virtual local history collection.

Both the librarians and the researchers believe that the EAD project will stimulate more donations to SUU's special collections. Janet Seegmiller, special collections coordinator, has already noted that potential donors are beginning to see SUU as an attractive repository for their personal collections.

Stevens Institute of Technology

Electronic Access, Not Subscriptions

http://www.lib.stevens-tech.edu/index.html

BACKGROUND

Stevens Institute of Technology is an urban university located in a park-like setting in Hoboken, New Jersey, across the Hudson River from midtown Manhattan. Stevens offers baccalaureates, master's, and doctoral degrees in engineering, science, computer science, and management, as well as a baccalaureate degree in the humanities and liberal arts. It enrolls some 1,400 undergraduates and 2,000 graduate students, who are taught by 102 full-time faculty. The institutional budget is $65 million, of which about $823,000 goes for library operation. There are five librarians and four support staff. Together with graduate student assistants, they provide services to Stevens students and faculty.

Stevens has a reputation for innovation and leadership in the use of computers in engineering. It was one of the first campuses in the country to be fully networked, to require that all entering students have personal computers (1983), and to offer online searching to all faculty and students as a fee-based service.

In 1991, at the direction of the Board, the university administration imposed an austerity program that included a reduction of $250,000 from the library's budget. That amount was about what the library was paying for its journal subscriptions. Library Director Richard Widdicombe and his staff, encouraged by the president and supported by the faculty, decided that only a radical new means of delivering information would allow the library to continue supporting teaching and research. The library would drop all research-oriented periodicals and supply the information by acquiring more electronic media and buying documents. (The library still subscribes to some 150 general-interest magazines.) With a network-connected computer on the desk of every faculty member and student, it was time to experiment with a new way of delivering journal articles to the Stevens community.

The decision to rely completely on electronic access is still controversial, as it certainly was in pre-World Wide Web days. But it was

preceded by more than 15 years of research and experimentation, inspired by curiosity about what research tools were being used and budget limitations on subscriptions. The periodicals list had long been held up to rigorous scrutiny, and the college had been winnowing its subscriptions for some time. Beginning with some 1,500 titles, the list was down to just over 500 by the time the decision was made to drop paper-based research periodicals.

In its efforts to cull periodicals, the library had employed several strategies to identify the most effective core for supporting chemistry, physics, mathematics, and the engineering curriculum. It used the database and hardware of the Philadelphia-based Institute for Scientific Information (ISI) to compare ISI's *Science Citation Index* with the holdings at Stevens and with the titles cited in Stevens journals. Titles were ranked by frequency of "hits." Journals not cited and little used at Stevens were eliminated.

Subsequent efforts included asking faculty for candidates for weeding and affixing cards to periodicals urging browsers to mark each use. Combined circulating and browsing statistics were compared with those of other libraries that supported engineering programs, to learn which journals had the highest use by students and faculty. The experiment revealed that use of periodicals is quite specific to an institution and that most journals in an engineering college become dated only a year or two after publication. The library staff also surveyed publications authored by Stevens faculty for source citations. They found that a wide variety of sources were cited, but no identifiable core of journals.

During the process of trying to assemble the best collection of periodical titles for their purpose, new notions of library service began to surface. As Library Director Widdicombe has written, "This led us to two conclusions. It is more important for college libraries to devote themselves to the user needs of their own faculty, staff and students than to theoretical concepts of building a great, well-rounded journal collection. Also, a 'just in time' acquisition philosophy was imperative. So we instituted a rapid purchase plan for new books, monographs and journals."

THE PROJECT

The idea of switching to machine-accessible information was more than acceptable to both the library staff and the library's primary clientele. The library staff had been noticing that even when library users were told the online versions lacked the accuracy or depth of printed indexes, they abandoned the printed versions anyway. But the groundbreaking decision to drop several hundred subscriptions to technical journals at a technological university required a safety net. That net was provided by an existing resource base, the libraries of Manhattan, and by an additional resource, the not-for-profit Engineering Information (EI) Company from New York City, which relocated to the Stevens campus. (EI was subsequently acquired by Elsevier Science, Inc.)

Engineering Information, in particular, was a bridge between promise and reality. After the budget cuts, Stevens was unable to provide effective just-in-time or on-demand delivery of journal articles, either through interlibrary loan or commercial document delivery services. With its broad access to articles from engineering journals, EI agreed to provide its services free of charge to Stevens. Its presence on campus and willingness to experiment with document delivery produced a powerful synergy that provided the backup the library needed to begin its technological revolution.

Even in the current Web-based environment, abandoning journals central to the curriculum and research activities of a college or university is controversial. And in 1992 the resources now accessible online were not yet available. Starting with a combination of article identification and delivery services such as UMI, CARL, FirstSearch, and various CD-ROMs, and the presence of EI, Stevens launched its experiment.

The decision to switch to the new system was made by the library director, who by 1992 was a 25-year veteran at Stevens. His decision was based on the following:

- Data that he collected over 15 years convinced him that his clientele had very specific needs and would not care where the information came from.
- Stevens Institute, with its emphasis on technical training and practical research, did not need the broad categories of information traditionally associated with liberal education.
- It was clear that the budget would never allow the purchase of sufficient resources—books or journals—to meet the needs of Stevens faculty and students.
- With the advent of searchable electronic databases, those libraries able to identify specialized information needs of their clientele could be at the forefront of a paradigm shift in which quick access to information would be more important than owning it.

Considerable planning was done before the periodical subscriptions were dropped. The deputy director, the faculty library committee, and the president participated in the process. Both supporters and critics on the faculty were visited by the librarians, who explained and then demonstrated how to use online searching. In one case, members of a highly critical department were convinced by the power of online searching when a librarian produced an ample bibliography on a subject that they believe to be of interest to relatively few scholars in the world.

Concurrently, the library discontinued its attempts to build the book collection in a general way. Instead, based on the kind of usage studies conducted earlier on journals, the acquisitions strategy shifted to buying specific books as they were needed. Users were urged to recommend books, which were then purchased. Similarly, with a librarian's permission, students and faculty could go to Manhattan to purchase books they needed. When the books were turned in to the library, the buyers were reimbursed.

RESULTS

Under the new system, research processes have been expedited. Students and faculty can look quickly at full-text articles. Students can create electronic bibliographies, check the full text, and then rework their research path, moving forward in the same or new directions.

This experiment is more than seven years old, and much has changed since 1991. Faster and more comprehensive databases have appeared. Other academic libraries relying on digital-based information are ending subscriptions to paper editions of reference books and journals. Few, however, have been so bold as Stevens.

The people at Stevens know their actions were controversial and are proud of that fact. They were aware of outside doubts, but believed their situation called for a transformation of library services because the old ways were not working. They believe they are future-oriented and are willing to take risks to be at the forefront of what they believe will be a major paradigm shift. They predict that research information will no longer appear in published articles, but will be juried and rated by scholarly centers and then distributed electronically. Stevens staff members believe they have left the print-based industrial age and moved squarely into a world where information will be decentralized and transferred by high-speed telecommunications and computers.

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Impact on the Library

The library has had to make trade-offs in order to provide electronic resources. Fewer people come to the library. Librarians miss the contact with students and faculty, but they are aware of similar trends elsewhere as libraries offer more electronic resources. The number of books in the library is not growing much and back issues of journals are gone; consequently, space is less of a problem and the library staff plans to establish clusters of workstations in the freed-up spaces. Dropping research journals suggests large cost savings, but some of the savings in subscription costs were lost to subsequent budget reductions. On the other hand, dealing with the cutbacks made cost transfers easier to accomplish. As one would expect, budget lines for journals and monographs fell off sharply, but since 1991, costs associated with electronic resources have risen, as have expenditures for personnel.

Most important, the library staff believe that their model of information delivery is better than the traditional model, in terms of the range of information services they can provide. They are quick to point out that their model would not work for everyone. But if data on the information needs of a library's clientele are collected, if the technical infrastructure is present, and if the users are open to change, then bold leadership can transform the way information is provided, as Stevens has shown.

Adopting this model, the librarians say, has changed the way the staff is organized and carries out its responsibilities. Because there are fewer visitors to the library seeking traditional reference services, the two informational services librarians spend less time in the li-

brary and more time in faculty offices and classrooms, demonstrating new databases, teaching their use, and soliciting suggestions for additional resources. Users also do more work from home, since everyone has a computer and most reference services can be delivered online.

The librarians at Stevens are keenly aware that their early, just-in-time model stretches or even breaks some of the time-honored tenets of academic libraries. For example, the Stevens model is based on the following premises:

- It is more important to provide students what they want on demand than to emphasize the development of bibliographic skills for searching older literature.
- It is more important to concentrate on expedited service than to develop a broad range of materials to support the curriculum.
- It is in the library's interest to reduce its collection for the sake of expanded access.
- Archival or preservation responsibilities are not an important part of the library's work.

The Stevens librarians justify their approach as follows:

- Their model provides access to many more articles than the old model because money is spent on what people want, not for journals that sit idly on the shelf.
- Since it is impossible for the library to support research and teaching using traditional collection development, it will put its resources where they are most effective.
- The few demands for non-current historical information can be acquired through interlibrary loan.
- Although Stevens cannot help large research libraries archive or preserve historical data, the library will encourage them to do so by paying fees for an archival product.

The Industry Connection

The EI connection has brought an immense benefit to Stevens and provided a safety net for its decision to drop the journals. Equally important, EI brought a corporate culture to an academic institution. It provided high-level technical jobs for students, along with its willingness to experiment with new computers and document delivery. Hence the library became the beta site for new programs. The pool of motivated students, matched with computer resources, was able to provide the library with all the technical support it needed.

Eric Johnson, Executive Vice President of EI says that the organization also benefited from the move to Stevens. In exchange for EI's services (for example, EI pays the copyright fees for documents delivered to the Stevens community in printed and electronic form), Stevens provides space for EI's operation.

User Satisfaction

Everyone interviewed—members of the Library Committee, elected and appointed faculty, undergraduate and graduate students, and the director and deputy director of the library—clearly supported the Stevens Library project. They spoke of making the best of fiscal realities and of quick retrieval of up-to-date information for themselves and their students. They said that, by and large, everyone is motivated; although they will not know for some time whether it will work in the long run, they believe there is no choice but to make it work. "History will judge us," said one professor, and the others agreed. Stevens faculty send out a lot of grant requests, and the reduced library collection has not hurt grant writing. The proposals simply list the databases available for the research.

The committee members consider Stevens to have astute, forward-looking librarians who are open to suggestions, particularly when it comes to database selection. They miss Friday afternoon browsing through journals in the library, but understand it had to be one way or the other. When asked if all faculty feel as positive as the committee, one member said, no, that there are a few who complain, but that they are the ones who did not use the resources anyway.

The committee members reiterated that Stevens is unlike most colleges and universities. Many of its students are first-generation Americans who pursue an education to get ahead financially. They have exceptionally high math and analytical skills and are willing to work hard because the curriculum requires it. They know Stevens graduates have an advantage in the job market because they are well prepared. They use technology; indeed, they demand it. Thus, Stevens students are naturally supportive of a just-in-time strategy. The faculty has not only led the students, but sometimes followed them.

Wellesley College, Margaret Clapp Library

A New High-Tech Center

http://www.wellesley.edu/infoservices.html

BACKGROUND

Wellesley College, located in Wellesley, Massachusetts, near Boston, was founded in 1870 and admitted its first degree-seeking students in 1875. It is a medium-size liberal arts college for women with an enrollment of about 2,300 students. There are 333 full-time and part-time faculty members. In 1998-99, its operating and capital budgets were about $130 million, and its endowment stands at $780 million. Wellesley is a merged-technology environment, with both library and computing staff reporting to the vice-president for Information Services, who is also the college librarian.

The Margaret Clapp Library's holdings number more than 1.3 million books, periodicals, microforms, music scores, sound recordings, videocassettes, maps, and CD-ROMs. It also houses an important collection of federal and international documents. The special collections include letters, manuscripts, and rare books; the archives contain materials documenting the history of the college.

The library employs 14 librarians, one archivist, and about 23 full-time support staff. In addition, the library hires the full-time equivalent of about 26 student assistants. The library's FY 1999 budget is $4,917,559.

THE PROJECT

As early as the mid-1970s, a technology review committee advocated forming a center that would bring together information resources and new technologies. In the early 1990s, the college began strategic planning for improvements in the media facility, including the language laboratory and audiovisual services, both of which were located in the library although they were not under its administration. The planners included staff from the library and Computing Servic-

es. As planning progressed, it became clear that electronic resources, including the Web, would figure prominently in the future of information delivery. The college and the library would be left behind unless they integrated new information technology. This meant that the library and Information Services would have to work together in a more systematic way.

A gift to the college in 1996 from Betsy Wood Knapp proved timely. Knapp, a professional in communications technology, donated funds to support the creation of a high-technology media center on campus. She viewed the center as providing "a facility for people to learn, so they can then use their imagination to create new ways of seeing things." The establishment of the Knapp Center would also support two of the college's goals related to the use of information resources and technology:

- to ensure that a working knowledge of technology is an integral part of every student's Wellesley experience, both by integrating information technology with the curriculum and providing an array of networked resources and services; and
- to empower the faculty to use information technology effectively for both curricular and scholarly purposes, through a collaborative training and support effort involving faculty, staff, and students.

In 1997, Wellesley opened the Betsy Wood Knapp Media and Technology Center, located in the Margaret Clapp Library. The center brings traditional library functions, such as course reserves and microform collections, together with media services, language instruction facilities, audiovisual production areas, and multimedia workstations. The Knapp Center provides Wellesley faculty, students, and staff with greatly expanded opportunities for innovation and integration of new technologies into their learning experiences. It enables the blending of video, audio, film, graphics, and the full range of library resources.

The 17,000 square-foot center has 43 large workstations, fitted with many combinations of equipment, including flatbed scanners, VCRs and monitors for both U.S. and foreign videocassettes, and laserdisc players. Both Pentium II PCs and Macs are available. Portable tape player/recorders can be borrowed and used in any of the carrels for language listening and vocal practice. A large-format printer (for printing posters or large artwork on paper or other materials) is also available. Current software includes Photoshop, Acrobat, Illustrator, PageMaker, Persuasion, Premiere, Director, Authorware, and Flash.

The workstations are configured for both collaborative and individual work. There are 25 carrels that can accommodate two or three people and 18 carrels for individuals. Faculty and students working in groups can use one of the center's four project rooms. These spaces offer larger-screen monitors for videos, conference tables, and computers. Other rooms are equipped for linear and non-linear editing. There is a video production studio that is large enough for filming interviews or small group projects.

Once the center was established, it made special efforts to draw in new users. Center staff held events, including open houses, demonstrations, and tours, to show faculty, students, and administrative staff what was being implemented. Special grants made it possible for a selected group of student interns to receive advanced training in the use of instructional technology applications. The students apply this knowledge to help faculty members as they develop curricular projects. The manager of Advanced Technology Applications selects the student interns. The library has participated in some of the projects, working with the interns to identify and structure the appropriate information resources.

Course reserves have been integrated into Knapp Center services. Using the electronic reserve system, students can print copies of assigned readings as needed. The Knapp Center also lends the nonelectronic reserves (books and other materials) that faculty have identified as high-use items.

The Process

The stage was set for merging the library, computing, and media services into a single information services unit in 1994. That year, the college administration decided to elevate the library director, Micheline Jedrey, to senior staff, making her vice president for Information Services (she also holds the title of college librarian). Library, computing, and media services staff report to her, and she reports to the college president. Besides integrating staff under her leadership, the promotion gave her access to decision makers and allowed her to advance the library's role in planning for media, technology, and space. She said that she doubts the library would have received funding to expand its functions if she had not been part of the senior staff.

Planning for the merged information services unit began in 1995 and was led by Sally Linden, research librarian. The planning group consisted of faculty from various disciplines and members of the Information Services staff from various departments: Advanced Technology Applications, Systems and Networks, User Services, Media Services, Library Systems, and Course Support Services (course reserves).

Conceptualizing the center's services and its design required extensive consultation and collaboration within the Information Services organization. The Knapp Center is now a physical manifestation of this merged organizational effort, and the staff of the center are drawn from the library, Media Services, and the Advanced Technology Applications group. The center also employs more than 40 student assistants who have worked in various parts of Information Services.

The decision to locate a high-technology center in the library, as opposed to elsewhere on campus, was the result of some deliberation. For example, the language departments, which had outdated facilities in the library, envisioned a new lab in the building they oc-

cupied. There was also some resistance to the idea of a librarian leading the planning process. But the library had the compelling advantages of being open the most hours per week and having staff that could support technology functions. Ultimately, these were critical in the final decision.

RESULTS

In reviewing the project, Jedrey believes that the design has worked well. Although staffing issues must still be resolved, the library's position on campus has been much strengthened, and the center's facilities have begun to significantly affect the modes of teaching and learning at Wellesley. This innovative facility can be a model for other college libraries to consider, breaking ground in the integration of library and information technology services. The success of the Knapp Center is summed up by Associate Dean Lee Cuba: "The Knapp Center has become a major site for learning on campus and its multi-use function has catalyzed what was already there."

In evaluating the outcomes of the project, two questions might be asked. How has the technology offered by the Knapp Center improved learning? And how do the functions of the Knapp Center relate to the more traditional library functions? The views of faculty, students, and administrators provide some answers.

Staff Response

Bringing more technology into the library has placed new demands on staff. "Feelings of frustration and incompetence with the new systems pushed some people beyond their tolerance," says Jedrey. The library has made efforts to help staff develop new skills through technical training. "Cross training is a strong issue. It took a while to sort out how much to expect from each level [of expertise]," says Diane McCorry, co-director of the Knapp Center. But in some areas, notably the electronic reserve desk, staff continue to struggle with library technology and have had difficulty viewing their jobs more broadly. In the future, Jedrey says, "bridge builders and transition managers will be the ones to succeed."

Several staff members noted that the open design of the office space made their jobs more difficult. The reduced privacy makes them more vulnerable to interruptions and distractions.

Faculty Response

Faculty members from several departments have started to use multimedia materials in teaching, but it is hard to systematically evaluate multimedia's impact on learning. First, its broad availability at Wellesley is so new as to be still experimental. Second, educators have not agreed on a way to evaluate objectively the benefits and drawbacks of technology-based learning. There is, however, ample anecdotal evidence to provide some clues. A common observation of

faculty, from sociology to languages to the sciences, was the strength of multimedia in allowing instructors to "show rather than describe."

Some of the strongest endorsements have come from language teachers. A professor of French noted that exposing students to culture and context is an essential aspect of language training. Multimedia allows students to make associations between visual and auditory information that would otherwise take a long time. "Multimedia gives students access to meaning through image," he notes, which is especially important when English is not used. He believes that the use of multimedia has doubled or tripled his effectiveness in teaching. He also notes that using the computer to project the course outline allows the students to maintain their concentration collectively, rather than focusing their attention on photocopies.

A professor of German added, "Multimedia has not replaced the core, traditional curriculum," but it has provided students tools for research and production of projects. The professor cited one example, "Berlin in the Twenties," a Web-based project to which each student contributes one piece of research, using a variety of multimedia sources. The Web resource will then form the basis for a writing project.

Has access to the Web and new technological possibilities enhanced the use of the library's print and other resources or the expertise of its staff outside the Knapp Center? The answer to this question is ambiguous. Some faculty members who use the new technology admitted that they had not drawn much on the services of library staff or on library materials in developing their electronic curricula. The German instructor said she had not sought help with content for "Berlin in the Twenties," but she expected that librarians would help her use technology for the writing component. On the other hand, a professor of biology credited the library with introducing the faculty to digital imaging and scanning, and for providing students with technical expertise to help faculty members carry out ideas.

Some faculty members who have used the Knapp Center would like to use it more. A history of science professor offered an interesting example of how he has merged the content of the traditional library with the services of the Knapp Center. In his courses, he uses books drawn from the library's rare book collection. Many contain woodcuts that illustrate aspects of the history of science. He has scanned and then animated some of the illustrations to show, for example, complex motion. Giving students the chance to learn in a way that no book provides has been effective. But consulting the originals is also important. "Students are impressed by the book as object," he notes. As an added bonus, the books are old enough that the faculty member does not need to worry about copyright infringement when making parts of them available for online viewing.

Faculty members noted that learning how to incorporate the new technology into teaching takes time. They also noted that they must consider their students' level of familiarity with basic tools before

deciding how to use technology. For example, when students are asked to help build a Web site, not all students know hypertext markup language (HTML). Teaching it and working out the bugs takes a lot of class time.

A common observation of faculty, from sociology to languages to the sciences, was the strength of multimedia in allowing instructors to "show rather than describe."

Student Response

The success of the Knapp Center is evidenced in part by its popularity among students. Workstations are constantly in use. "See you at Knapp" has become an often-heard refrain. The center has become a social as well as intellectual magnet for students. But student users are not the only ones to benefit from the center's facilities. Student employees note that their work has allowed them to build important skills in information technology. Besides their important function in training faculty and fellow students to use the equipment and software, the students have developed skills that will be extremely valuable when they enter the job market.

Student users have reported that they are very happy with the range of software and equipment offered by Knapp. When pressed, however, student employees noted that it might be good to have more PCs in an "express" area, which would handle routine, simpler software so that machines with greater capabilities were available for multimedia work.

Some students and faculty noted that they viewed the Knapp Center as separate from, rather than integrated with, the library. One student mentioned the visual disconnect when the Knapp Center's high-tech design meets the conventional decor and traditional stacks of the main library. A faculty member in computer sciences agreed, saying that his students go to the Knapp Center—not the library. These comments underscore a key challenge for library staff. Having brought the center into their domain, they must now explore ways of integrating the traditional more completely with the high-tech. They have begun by making some administrative staff changes, including job swaps and cross-training, to reinforce the integration of the facility into other information-service offerings.

Administrator Response

Administrators unanimously said that the results of opening the Knapp Center were better than anyone expected. The biggest challenge for them has been ensuring the center's smooth functioning while also fulfilling responsibilities for purchasing such items as audiovisual and satellite equipment. Administrators are also aware of the impact the technology has had on teaching. According to Associate Dean Cuba, the impact of multimedia has been significant in the teaching of art history. "Tests have become harder," he says. Because students have better access to art images, they can more easily memorize and identify them. Tests can use embedded images, and students can spend less time describing and more time analyzing them.

Conditions for Success

What were the factors leading to the success of the Knapp Center? According to Sally Linden, project manager for the center, there were several.

- First, there was the confluence of a donor's desire with the need of the college. The $2 million gift provided funds for construction and outfitting of the center and included a $250,000 endowment fund for upgrades and new technology.
- A second factor was the extent to which planners worked with faculty in social sciences and humanities. It was important that faculty be part of the process and pleased with the result. This was especially true of the language faculty, since students in language courses would be heavy users of the center.
- A third factor was the cooperation of specific individuals in Information Services who had enough technical expertise to understand the whole picture, since no one on the planning staff had sufficient expertise. Linden notes that it was gratifying to see so many constituencies working together to "build the same house." She did not believe there were any significant trade-offs or compromises required during the planning process.

Next Steps

With the Knapp Center up and running, the library is now re-examining its role. What needs to be a library function? What should be an information services function? Or what should be a course function? How do students and faculty want to use information and how can the library help? What is the library's role in supporting basic courses? How does the library prepare itself to provide new services? The library director hopes that focusing on these questions during the planning process will lead to seeing services in a more integrated way and to viewing them from the point of view of the customer rather than from the professional perspective alone.

West Virginia Wesleyan College

Laptops for Every Student

http://www.wvwc.edu/lib/index.html

BACKGROUND

The West Virginia Wesleyan College (WVWC) in rural West Virginia is a private liberal arts college that enrolls 1,500 students and employs 85 full-time and 49 part-time faculty members, and a staff of 187 full-time and 83 part-time employees. The institutional budget is $30 million. The library has an annual budget of about $500,000, and the Centralized Computing Department's budget is $800,000. Three professionally trained librarians and nine staff members, along with 50 student assistants, constitute the library staff.

President William Haden characterizes the campus as follows:

- an egalitarian environment
- an institution that subsidizes a large number of students
- an institution that has limited resources and cannot afford to support different technology systems and platforms, making standardization essential

Thinking about how technology might be used on the college campus began as early as 1982, with a Benedum College Enrichment grant. A faculty member from Carnegie-Mellon University was hired to survey all of the colleges in the region with regard to their technology needs and future technology plans. Enough communality was found to suggest forming a Consortium of Colleges for Computing and Undergraduate Education. Twenty schools of similar size with similar needs, most along the Interstate 79 corridor, joined the consortium.

The consortium sponsored regional faculty institutes that were subject-based. Faculty members met periodically to describe their uses of technology in classroom teaching. These discipline-based workshops and meetings continue. Another organization, the Appalachian College Association (ACA), headquartered in Berea, Kentucky, has also assisted the faculty of WVWC by holding technology conferences organized along disciplinary lines.

An important by-product of this early consortium activity was that isolated faculty began to meet with their counterparts in similar institutions. Their common bond was the realization that they must find their own affordable solutions to the problem of implementing technology. They realized the futility of going to visit the large research universities in their region to see how they handled technology, for, as one faculty member related, "They simply throw money at the problem." And money is what none of the institutions in the consortium had.

THE PROJECT

When President Haden took office in early 1995, he came with a broad vision about technology, including the idea that each student should have a computer. He believed that a rural liberal arts college could survive only if it achieved distinction. A few months before Haden's arrival, the college's Faculty Computer Committee had begun to develop a technology plan for the campus. When the committee presented its report to Haden in the spring of 1995, he leaped at the opportunities it presented, but felt it should go further. "It is a good start," he told the committee, "but it needs to be a professionally crafted plan if it is to capture funders' attention." He appointed a strategic planning task force of 25 individuals, ranging from students to trustees, to review the impact of technology on the entire campus. The task force was asked to look at networked resources and academic and administrative computing to see what it would take to create a mobile computing environment. The president worked with the Faculty Computer Committee to identify and hire a consultant, Charles Folkner of GFI, to work with the strategic planning task force to develop a comprehensive technology plan.

President Haden selected Kathleen Parker, director of Library Services, to head the task force. Part of the reason for his choice surely had to do with Parker's collaborative style, but the president also had an unshakable belief that information resources—the library's province—are fundamental to a liberal arts education. Parker is quick to point out that although technology is a tool for providing access to resources, the library remains primarily concerned about the resources themselves and their usefulness to the students. (Even though the students with laptop computers now have access to a wide array of materials online, 17,453 personal visits were made to the library during the month of September 1998.)

A member of the strategic planning task force, Richard Clemens, believed that providing equipment would be meaningless unless the faculty were trained to make good use of the technology. Clemens, who was a faculty member in the Department of Business and Economics, offered to spend his sabbatical year meeting with each faculty member to discuss how to promote the use of technology in his or her teaching. He was convinced that technology offered the most promise for doing dramatically different things and he persuaded the college to make this investment in him.

After the strategic planning task force completed its plan, which the college trustees approved, Haden dissolved the task force and formed a Council on Technology to oversee the plan's implementation. The Council was composed of four faculty and four staff members.

Getting the Equipment

Funds from an alumnus/trustee and corporate subsidies from IBM, along with rebudgeting of the college's own resources, paid for the equipment. The result is that since 1997, every student in the entering freshman class has received a laptop computer equipped with standard software. Although the WVWC campus had been primarily a Macintosh-based campus prior to 1995, the consultants insisted, and the information technologists agreed, that the plan's success hinged on conformity: a standardized platform and the same software packages on every piece of equipment. Laser printers are networked in the library for student use. They are much more heavily used than anyone predicted. The college is considering a proposal that would give each student a printing allowance of 500 pages per year, with additional printing done on a fee basis.

The faculty enthusiastically embraced the plan to adopt technology as the transforming agent. The rate at which the plan proceeded reveals this enthusiasm. Many of the faculty members who were interviewed pointed out that the plan presented by the strategic planning task force was approved unanimously. In the academic environment, known for its conservatism and usual reluctance to move quickly, it is almost unheard of to reach unanimous agreement.

Providing the Training

The president recognized from the outset that the program to revitalize the campus could never succeed if the technology plan were partially implemented. Fully aware of the immensity of the undertaking, he pledged to tackle all parts of the transformation simultaneously. Faculty members received the personal assistance and group training that were necessary to give them confidence in the new way of doing things. They were able to travel inexpensively to workshops and technology conferences organized by the ACA, and were encouraged to learn as much as possible early in the plan's implementation. Staff was added to the service points—the computer center and the library—to work with faculty to design courses and provide training and assistance. Presumably, the high front-end cost of this support will gradually lessen as faculty members become more confident and self-reliant.

For the librarians, there has been a non-stop period of learning since the technology plan went into effect. Parker spearheaded a training program to bring all of her staff up to a base level of technological literacy. Building on that base, individual library staff members have taken responsibility for detailed knowledge of specific

software packages and applications. They turned instinctively to the Information Technology staff for help and support. Perhaps because of the close collaboration between the two staffs during the development of the technology plan, an atmosphere of collegiality and common respect has been solidified.

Teamwork with Computer Services

Computer Services concerns itself with connectivity—making certain that every member of the campus community has access to the network—and with training that enables full utilization of the network. The library sees its role as selector of content. The librarians are proud to say that there is nothing on its Web pages that has not been evaluated in the same way a book or journal would be. The librarians work with the faculty to develop the electronic resources to be mounted on the Web. The library's Web pages are maintained by a computer science student, and he has found that helping the library manage its electronic resources has significantly enhanced his understanding of the library.

The Computer Services staff has doubled to meet the public service and training demands. The staff offers a series of faculty training programs during the lunch hour, mostly demonstrations of electronic resources that are available through the network. Library staff are also encouraged to attend these sessions. Two members of the Computer Services staff are specifically assigned to work with faculty. They are convinced that this is an essential part of helping faculty put the electronic resources to good use in the classrooms.

RESULTS

The optimistic spirit the case-study interviewers first encountered in an early morning meeting with President Haden pervades the campus. The faculty believe they can offer more to their students and gain better access to research resources for themselves through the technology. Librarians and computer center staff take enormous pride in the extent to which their knowledge and expertise are central to the campus goals. Students believe the college is changing for the better, although they have quite different expectations than the older members of the campus community—they take technology as a given. They are not dazzled by the abundance of resources, unlike those who have made do without them.

The collaboration of the library and the computer center has been highly successful. All but five faculty members have adopted the technology as part of the teaching process, and everyone on the campus is using e-mail. The faculty received their computers in January 1997, and by April electronic communication was universal. Computer Services hired students to teach faculty one-on-one in their offices. These students have continued collaborative relationships with the faculty after their official duties ended.

Faculty members describe themselves as managers of the learning process, rather than deliverers of information.

Library and Computer Services Response

Both library and Computer Services staff believe the technology program has greatly increased the enthusiasm on campus. They have found that few of their peer institutions have taken such a comprehensive approach. They believe the network is the central feature of the plan. As liberating as the laptops are, it is the connection to the vast world of knowledge in electronic form that gives the college a new lease on life. Both library and Computer Services staff stressed that other colleges wishing to pursue a similar approach need to concentrate on training, technical support, and integrated content.

When asked to talk further about changes the technology has brought to library services, library staff first described the advantages to students:

- Students have more flexibility in doing their work and they are more independent.
- Students have access to vastly more resources than a small stand-alone library could ever provide.

The library has been forced to make trade-offs to provide electronic resources. Binding of journals, for example, has been significantly reduced. The current policy is to select the top 20 journal titles for binding. The rest are kept unbound in closed stacks, from which materials can be retrieved by library staff only. The librarians are concerned about this lack of attention to preservation, but made the trade-off for access instead, with the full support of the faculty. The library has also canceled some lesser-used journal titles, again after consultation with and support from the faculty.

The librarians are openly appreciative of the support they receive from the president. In turn, they feel that their ability to extend library services through technology contributes to the president's vision for what can be accomplished at WVWC. The librarians also point out that the library's first goal remains constant, with or without technology: quality customer service. One of the librarians characterized the changes wrought by the technology in this way: "Life for the staff is entirely different—everything is new, and is always changing." And the changes apparently are welcomed, for the optimism of the staff is remarkably evident.

But library staff members, though enthusiastic, are not naive. The librarians also recognize the pitfalls of the Technology Plan, which they characterize as follows:

- The staff is stretched too thin.
- There is not sufficient staff to accomplish all that the library wants to do.
- Continued financing for the transformation is a big risk.
- Obsolete equipment is a constant worry.
- Stability is elusive.
- Technical support staff are very hard to find and keep.

The library staff observed that the responses from students and faculty have varied. Student expectations are very high—"[Shopping on the] L. L. Bean [Web site] is their model," the director of libraries observed. Faculty are more concerned that technology not supplant

the most important attribute of the college—highly individualized attention. The library shares the faculty's philosophy and takes strong measures to emphasize the core values: a commitment to books and learning. For example, the library has used the technology for a "Books of the Week" promotion. Each week, library staff select three or four books to highlight. They scan the book covers and mount them on the library's Web site. They write abstracts of the books and connect the visual files to reviews of the book or to interviews with the authors, and distribute this information over the network. This activity, the librarians believe, gives the faculty confidence that the library is using technology to promote reading.

Faculty and Computer Services Response

Computer Services staff and some of the faculty observed that the technology has changed the approach to teaching. Very few faculty members lecture any longer. Group projects are far more common. Faculty members describe themselves as managers of the learning process, rather than deliverers of information. Student learning is taking place in a much more interactive environment.

The Computer Services staff working with the faculty described the liabilities of the technology in this way:

- There is not enough money.
- Faculty member have to give up time in the classroom to group projects.
- Everyone gives up some level of privacy.
- It is hard for the faculty to find time to learn so many new things.
- The faculty needs more development funds for additional training as well as time off from teaching to participate in training.

Student Response

Many students interviewed were seniors who did not receive laptops from the college. But they clearly see the changes that have occurred on campus since the technology plan was implemented. The most obvious difference is that "we have Internet access in our dorm rooms," said one. "Before this technology project, half of the students on campus did not even know about e-mail." They also agreed that the underclassmen who have laptops have greater advantages than the juniors and seniors, who do not. Most of the students admitted with amusement that while they come into the library often in search of quiet study space, they do most of their research on the computer. How? They get to know the freshmen so they can borrow their laptops.

All of the students agreed that the technology program provided a significant recruiting "hook" for the college, and all hope their employment prospects will be enhanced by the college's new image as a "ThinkPad University."

The students, more than any other group interviewed, expressed concerns about the technology program. Their greatest regret was

that training had been focused on the faculty. One student flatly asserted, "There has been no training for students." Several pointed out that the effectiveness of technology in the classroom depended largely on the professor and his or her attitude toward technology. A few students complained about the exasperating moments caused by unfamiliarity with the technology or unavailability of a printer at a critical moment. One student said wistfully, as if thinking back to an older time, "I miss paper to hold and to highlight with my marker." Other students were concerned that computer interaction, while flexible and not time-bound, is not a satisfactory substitute for human interaction in the classroom.

When asked what WVWC should do differently with its technology program, students quickly offered these answers:

- Give students more training on how to use the Internet.
- Teach students how to evaluate what is on the Internet.
- Substitute a three-hour Internet course for the library instruction course.
- Make the Computer Services help desk as friendly and helpful as the library.
- Understand that the new program does not help those who don't get laptops (upperclassmen).
- Ask the library to teach students to search databases more effectively.

Further Faculty Response

The faculty interviewed were enthusiastic. A biology teacher was elated about possibilities for staying current in her field, now that she is connected to electronic journals, research libraries' online catalogs, and her colleagues in other institutions. She also loves the ability to involve her students in virtual scientific research on the Web, research that would be impossible in a modest college laboratory.

An education faculty member sees the college's initiative as a perfect way for students to learn how the technology can be used in the classrooms to which they will soon be moving in their professional lives. All of the education majors learn to use the technology for their presentations.

The education faculty's findings about the technology program are as follows:

- Faculty do not have to assign the technology; students simply use it.
- Faculty members have to specify the requirement to use print resources.
- Students are entering college better prepared to take advantage of the technology.
- Students are becoming dependent upon the network and electronic resources.
- Students are using the technology as their main tool to retrieve information.
- Students are becoming more sophisticated users of databases.

- The greatest need is to teach students how to evaluate Web-based resources.

A faculty member from the Communications Department, as one might expect, is most interested in the technology's ability to provide a new venue for campus communications. In zealous language, he talked about the transformation of the academy that includes extending classrooms beyond time and place and providing more opportunities for students. He described the improvements in faculty-to-faculty dialogue through e-mail and noted e-mail's ability to erase some of the disconnection that minority students feel in this isolated, rural campus. On a purely practical note, faculty can also distribute news of job openings and graduate school opportunities very quickly through the network.

The technology program is not without some problems for the faculty. All of them agreed on these particulars:

- It takes a lot of time to create technology-based courses.
- No one yet knows what effect electronic communication will have on human interaction.
- The expense of the technology is worrisome.
- There are constant maintenance and upkeep requirements.
- Equipment failures range from annoying to debilitating.

Administrator Response

President Haden is eager to see faculty members incorporate more technology into their teaching. He is spearheading a grant request to develop a wired classroom that will allow for a series of courses in which math, science, and computer literacy are brought together. He believes this will enable the faculty to restructure the curriculum to take advantage of the technology. President Haden also takes the view that the college must monitor the effects of this program on the campus. He has encouraged the college to adopt the Teaching Learning and Technology Roundtable (TLRT) model of Steve Gilbert, from the American Association for Higher Education, to survey the faculty for their perceptions of the influence of the technology program on teaching and learning.

The president's vision of a first-rate liberal arts college is infectious. The computing center and library staff are highly motivated to help achieve his vision through the technology. They, perhaps more than other groups, believe the technology has enhanced their roles: they feel more central to the institution and are pleased to be offering more services. The trustees approved the technology plan because they were convinced something different, by an order of magnitude, was necessary to assure the institution's survival. In short, the administration of the college has bet on this plan, and the stakes are high. The college is currently operating at a deficit in order to gain momentum. Each entering class of laptop students adds $300,000 to the operating budget. The college expects increased enrollment to offset the additional costs.

The dean of the college, Richard Weeks, joined the college in July 1998. A historian, he readily admits that he is not a technology enthusiast. In discussing his vision for the college, he focused on curriculum and the need to reconceptualize it thematically. He agreed with others that the college's primary need is to distinguish itself and believes the technology plan has moved WVWC in that direction. "But," he cautioned, "the technology is only a means to an end. Students must leave the college believing the curriculum prepared them well for graduate school or jobs."

Challenges

The challenge for the college is to sustain the program. The president and trustees have done an excellent job of securing funds to launch the program. Thus far two freshmen classes have been issued laptops. The next phase of implementation calls for continuing the effort for two more classes, yielding a fully equipped student body. Although the original plan assumed that upgrades would be required every four years, the college now expects to upgrade and refresh the equipment every two years. All full-time faculty have laptops, but the college wants to equip all of the part-time faculty as well.

West Virginia Wesleyan College's future hinges on the success of the technology program. It has spent large sums of money on connectivity and computer equipment—money that will have to be repaid with increased enrollment in the future. And the college has knowingly assumed a large, ongoing burden for new and refurbished hardware and software. It is the president's leadership that offers the greatest hope for success. The high level of confidence placed in him by faculty and administrative staff is key to the progress of the institution.

Appendix

CLIR Belmont Conference Participants
March 25-26, 1999

Willis Bridegam
Librarian of the College
Robert Frost Library
Amherst College

Lynn A. Brooks
Vice President for Finance
Connecticut College

Joel Clemmer
CIT Director
Macalester College

David Cohen
Associate Provost for Academic Affairs
Robert Scott Small Library
College of Charleston

Pam Craychee
Director
Library Center
Point Park College

Kimberly Douglas
Director
Sherman Fairchild Library & Technical Information Services
California Institute of Technology

Connie Dowell
Dean of Information Services & Librarian of the College
Charles Shain Library
Connecticut College

Ray English
Director of Libraries
Mudd Center, Oberlin College Library
Oberlin College

Diana T. Graff
University Librarian
Gerald R. Sherratt Library
Southern Utah University

William Haden
President
West Virginia Wesleyan College

Michael Haeuser
Librarian
Folke Bernadotte Memorial Library
Gustavus Adolphus College

Victoria Hanawalt
College Librarian
Eric V. Hauser Library
Reed College

Brian Hawkins
President
EDUCAUSE

Barbara Hill
Executive Director
American Council on Education

Micheline Jedrey
Vice President for Information Services and College Librarian
Margaret Clapp Library
Wellesley College

Susan Jurow
Executive Director
College and University Personnel Association

David Lewis
Deputy University Librarian
Indiana University/ Purdue University at Indianapolis

Deanna Marcum
President
Council on Library and Information Resources

Appendix: Conference Participants, continued

Neil McElroy
Director of Libraries and Academic Information Resources
Skillman Library
Lafayette College

Jacob E. Nyenhuis
Provost
Hope College

Marc Pachter
Counselor to the Secretary
Electronic Communications and Special Projects
The Smithsonian Institution

Kathleen Parker
Librarian
West Virginia Wesleyan College

Susan L. Perry
College Librarian and Director
Library, Information and Technology Services
Mount Holyoke College

Gloriana St. Clair
University Librarian
University Libraries
Carnegie Mellon University

Abby Smith
Director of Programs
Council on Library and Information Resources

Christopher W. Starr
Chair
Department of Computer Science
College of Charleston

Richard Widdicombe
Director
S.C. Williams Library
Stevens Institute of Technology

Clara Yu
Director, Project 2001
Center for Educational Technology
Middlebury College

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COUNCIL ON LIBRARY AND INFORMATION RESOURCES

1755 MASSACHUSETTS AVENUE, NW, SUITE 500, WASHINGTON, DC 20036-2124
Telephone: 202.939.4750 • Fax: 202.939.4765 • E-mail: info@clir.org • Web: www.clir.org